TWO ESSAYS ON UNDERWRITER COMPENSATION FOR INITIAL PUBLIC OFFERINGS

By

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To My Wife, Hsiu-Chuan (Jenny) Yeh

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Abstract of Dissertation Presented to the Graduate School
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Gross spreads received by underwriters on initial public offerings (IPOs) in the U.S. are much higher than in other countries. Furthermore, I find that in recent years at least 90 percent of deals raising between $20-80 million have spreads of exactly 7.0 percent, three times the proportion of a decade earlier. Investment bankers readily admit that the IPO business is very profitable, and that they avoid competing on fees because they "don't want to turn it into a commodity business." This dissertation examines several features of the IPO underwriting business that result in a market structure where spreads are high and proposes some explanations for the high frequency of clustering at seven percent.

I also propose a game-theoretic model, as one possible explanation, for the pattern of clustering spreads for moderate-size offerings and of lower spreads for large offerings

in the IPO market. I show that investment bankers, while acting noncooperatively, may charge above-competitive spreads in equilibrium. The evidence of underwriting spreads from the 1990s is consistent with the implications of this model.

The dissertation suggests that although issuing firms face high and, for moderate-size deals, nonnegotiable spreads, issuers can still bargain on additional co-managers and receive more extensive analyst coverage.

CHAPTER 1
INTRODUCTION

"Going public" is an important decision in the life cycle of a company. It provides a firm with avenues to raise external capital for investment and future growth and at the same time creates a liquid outlet for the original shareholders to diversify their investments. One issue regarding initial public offerings (IPOs) of equity is the direct cost (a gross spread) paid by IPO firms to underwriters who play an important role to assist firms to go public. See, among others, Barry et al. (1991), Beatty and Welch (1996), James (1992), Lee et al. (1996), and Ritter (1987).

The dissertation is composed of two essays that study gross spreads and a possible pricing strategy used by underwriters. Chapter 2, the first essay, examines gross spreads received by underwriters in the U.S. for the period 1985-1998. Gross spreads in the U.S. are much higher than in other countries. I examine several features of the IPO underwriting business that result in a market structure where spreads are high.

Furthermore, in recent years at least 90 percent of deals raising between $20-80 million have spreads of exactly 7.0 percent, three times the proportion of a decade earlier. Investment bankers readily admit that the IPO business is very profitable, and that they avoid competing on fees because they "don't want to turn it into a commodity business." I provide several alternative explanations for the clustering of gross spreads at 7.0 percent and the increased clustering of spreads over time.

Chapter 3, the second essay, proposes a game-theoretic model, as one possible

explanation, for the pattern of clustering spreads for moderate-size offerings and of lower spreads for large offerings in the IPO market. I show that investment bankers, while acting noncooperatively, may charge above-competitive spreads in equilibrium.

The dissertation concludes with a summary in Chapter 4.

CHAPTER 2
THE SEVEN PERCENT SOLUTION

Introduction

On September 18, 1996, International Network Services went public, selling 2,500,000 shares at $16.00 each. The issuing firm paid a commission to its investment bankers, also known as a gross spread or underwriting discount, of $1.12 per share, or 7.0 percent. International Network Services was not alone in paying a 7.0 percent spread. In 1995-1998, for the 1,111 initial public offerings (IPOs) raising between $20 and $80 million in the U.S., over 90 percent of issuers paid gross spreads of 7.0 percent. Not 6.9 percent or 7.1 percent. Exactly 7.0 percent. It is widely accepted that there are fixed costs associated with issuing securities, leading to economies of scale in the costs of issuing debt, equity, and hybrid securities. For above moderate-size offerings, however, no economies of scale are evident.

The clustering of spreads at 7.0 percent has not always been present. There is much more clustering at 7.0 percent now than a decade ago, although the average spread on IPOs has not changed during this period. In the 1985-1987 period, only about one-quarter of moderate-size IPOs had spreads of exactly 7.0 percent, in contrast to the more than 90 percent incidence that has prevailed in recent years.

When one examines IPOs outside of the U.S., such as in Japan, Hong Kong, or Europe, one finds that the spreads are approximately half the level of those in the U.S.

And within the U.S., when one examines bond, convertible bond, and seasoned equity offerings, one finds that the spreads do not show pronounced clustering on one number.[1]

This chapter examines several possible explanations for the high average spreads on IPOs in the U.S., the striking fact that so many issuers pay exactly 7.0 percent, and the increase in clustering during the past decade. I argue that the spreads for most deals above $30 million are above competitive levels. One reason for this opinion is that, as already mentioned, the spreads are much higher than elsewhere in the world. A second reason is that if spreads were determined primarily by costs, the average spreads on $80 million deals would be lower than on $20 million deals. But they are not. And if costs were the main determinant of spreads, $40 million deals by risky companies would have higher spreads than $40 million deals by relatively easy-to-value firms. But they do not. A third reason for the opinion is that investment bankers readily concede that the spreads are high, "The fact is, we'd be cutting our own throats to compete on price."[2]

Ideally, we would like to have cost information to directly test whether the underwriter spreads that are charged are equal to costs, including a competitive rate of return on capital employed. Unfortunately, this information is proprietary. More importantly, there would be problems in interpreting the numbers, since many of the costs are hard to allocate, and the costs of operating a gold-plated operation are higher than for a bare-bones operation. In other words, the costs are endogenous. High spreads induce

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[1] See the appendix table in Lee et al. (1996).

[2] Attributed to the anonymous head of underwriting for an investment bank in Roger Lowenstein's April 10, 1997 *Wall Street Journal* column.

underwriters to compete for business by adding additional services.

There are several features of the IPO underwriting market that are conducive to high spreads. The importance of underwriter prestige results in a pecking order where few issuers will turn down a "bulge bracket" underwriter for a less prestigious one, even if it means paying higher fees. The importance of analyst coverage limits the number of viable competitors for a given deal, and leads issuing firms to choose a lead underwriter at least partly on the basis of characteristics unrelated to the fees charged.

Explanations that I present for the high average spreads, and the high frequency of 7.0 percent spreads, include the possibility of implicit or explicit collusion among investment bankers. Among game theorists, the term "implicit collusion" is used to denote an outcome in which sellers keep prices above competitive levels without explicitly colluding. In the implicit collusion explanation, individual underwriters realize that by undercutting spreads to win a deal, competitors will respond by charging lower spreads in the future, resulting in a lower present value of profits. The self-interest of each individual investment banker results in higher spreads than if the fees were at competitive levels. The logic is based on the Dutta and Madhavan (1997) model of a noncooperative game used to explain the high bid-ask spreads on Nasdaq stocks.

I also discuss several other, more innocuous, reasons for why IPO spreads are high. These reasons include the necessity of having high spreads in order to induce underwriters to do a credible job at certifying the quality of an offering. Also, while spreads are the primary direct compensation of underwriters, the money "left on the table" via the short-run underpricing of IPOs is an important indirect compensation, for underwriters are able to allocate this money to their favored clients. Alternatively, low

spreads would encourage greater underpricing as a way of reducing the expected costs of stabilizing IPOs, increasing the indirect costs to issuing firms. Another reason for high spreads is that the prospect of future underwriting profits induces an underwriter to be more concerned about its reputation, and therefore the "certification" function of underwriting is enhanced. Yet another reason is that high spreads induce underwriters to compete for business on the basis of analyst coverage, which enhances the liquidity of a company's stock.

There are some similarities between patterns of gross spreads on IPOs and those of Nasdaq bid-ask spreads. Prior to the publicity generated by Christie and Schultz (1994), Nasdaq market makers avoided odd-eighth quotes. In other words, quotes at $10, $10.25, and $10.50 were far more common than quotes at $10.125, $10.375, and $10.625. Various parties have argued that the avoidance of odd-eighth quotes facilitated either implicit or explicit collusion to keep the bid-ask spreads wide. (The evidence of explicit collusion was strong enough to result in a lawsuit settlement of approximately $1 billion paid by market makers.[3]) In the IPO market, the avoidance of spreads that are not exactly 7.0 percent could facilitate either explicit collusion or implicit collusion, in that it is readily observable (from the prospectus) whether one underwriter is charging a fee that is "too low." On the other hand, there is a tendency to have at least some clustering at integers in other markets, including the London gold market (Ball et al., 1985) and interest rates paid on bank deposits (Kahn et al., 1999) in spite of no requirement to avoid noninteger prices.

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[3] See *Wall Street Journal*, November 10, 1998.

Explanations for the increased clustering over time are harder to come by. It is possible that 7.0 percent has arisen as a focal point partly because issuers have placed relatively little attention on fees, and underwriters find it easy to justify a spread by pointing to previous deals done at the same spread.

The structure of the remainder of this chapter is as follows: Section 2 presents the facts on the distribution of gross spreads on IPOs in the U.S. over the 1985-1998 period. Section 3 discusses features of the IPO market that may facilitate high spreads. Section 4 discusses alternative explanations for the clustering of spreads at 7.0 percent. Section 5 discusses possible reasons for the increased clustering of spreads over time. Section 6 concludes this chapter.

The Facts

Data

I examine the spreads on 3,203 firm commitment IPOs from January 1985 to December 1998 covered in the New Issues database of Securities Data Company (SDC). Closed-end funds, American Depository Receipts (ADRs), real estate investment trusts (REITs), and unit offerings are excluded from the sample. The sample is restricted to equity IPOs with proceeds of at least $20 million, because the compensation for underwriting smaller offerings is much higher due to the diseconomies of scale, and these deals may be accompanied with underwriter warrants.[4] Throughout the chapter, the

[4] See Barry et al. (1991) for a description of underwriter warrants and related regulation.

proceeds exclude overallotment options, and are expressed in terms of dollars of 1997 purchasing power adjusted using the U.S. GDP implicit price deflator.[5] It is worth noting that in the U.S., buyers of IPOs pay no brokerage commission.

To examine the analyst coverage of IPO firms, I collected data from I/B/E/S (Institutional Brokers Estimate System). Using broker translation codes provided by I/B/E/S, I combined the SDC and I/B/E/S detailed history datasets and identified analyst coverage provided by managing underwriters and unaffiliated brokerage firms. Of the 2,968 issuing firms in the period 1985-1997, 2,911 IPOs have some level of research coverage tabulated by I/B/E/S within one year after the offering. The sample ends in 1997 because of this requirement.

Empirical Evidence of the Clustering of Underwriting Spreads at Seven Percent

Table 1 reports the number of offerings by calendar year, offering size, and gross spread. The aggregate percentage numbers for each calendar year are plotted in Figure 1. Inspection of Table 1 and Figure 1 reveals that the proportion of IPOs with a 7.0 percent spread shows an upward trend until 1995, when the proportion stabilized at around 77 percent. For deals with proceeds of $20 million up to $80 million, which are referred to as moderate-size deals, the increasing concentration at 7.0 percent is especially noteworthy. This is illustrated in Figure 2.

At the bottom of Table 1, and in Figures 3 and 4, I report the distributions after aggregating the years into three time periods: 1985-1987, 1988-1994, and 1995-1998. I

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[5] An overallotment option gives the underwriter the right, but not the obligation, to purchase additional shares from the issuer. The spread per share on these incremental shares is the same as for the rest of the issue.

also report the numbers by proceeds category: moderate-size deals, and large deals. In 1985-1987, 26 percent of the moderate-size IPOs occurred at 7.0 percent, with 46 percent at lower spreads and 28 percent at higher spreads. By 1995-1998, only five percent of these deals occurred at lower spreads, and only four percent occurred at higher spreads. Fully 91 percent of these moderate-size IPOs paid a spread of exactly 7.0 percent.

While the clustering of spreads has increased over time, in Table 2, I show that the average spread has remained virtually unchanged over the last 14 years.[6] This includes not only high-volume periods, but also the low-volume years following the October 1987 stock market crash. During the 1988-1990 period when there was relatively little equity-issuing activity, presumably there was plenty of excess capacity in the underwriting business.

In Figures 5 and 6, I show scattergrams of the relation between spreads and the logarithm of, respectively, either expected proceeds (Figure 5) or actual proceeds (Figure 6), for IPOs from 1998. Expected proceeds are computed as the midpoint of the file price range multiplied by the number of shares that are anticipated to be sold at the time of filing the registration statement. Inspection of these figures shows the strong clustering of spreads at 7.0 percent for deals with proceeds of $20 million (log(20) = 3.00) to $80 million (log(80) = 4.38). In Figure 7, I show the scattergram of the relation between spreads and proceeds for the subset of the deals with proceeds of less than $100 million,

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[6] The low value-weighted spread for large IPOs in 1998 is attributable to three very large IPOs (all over $2 billion) at gross spreads of approximately four percent. The spreads on the Conoco, Fox Entertainment, and Infinity Broadcasting IPOs were in line with predictions, given the size.

without logging the proceeds.

As reported in Table 1, of the 1,111 moderate-size IPOs in 1995-1998, 56 had spreads of less than 7.0 percent and 45 had spreads of more than 7.0 percent, according to SDC. When we inspect these 101 IPOs that apparently deviated from the 7.0 percent spread norm, it turns out that 38 of them had spreads different from 7.0 percent because of "rounding errors." Although there is no requirement that spreads be expressed as pennies per share, if a firm has an offer price of $13.50 per share, the spread tends to be either 94 cents (6.963 percent) or 95 cents (7.037 percent), rather than the 94.5 cents that would make the percentage spread equal to 7.0 percent. If we classify these cases as 7.0 percent spreads, there are only 63 of the 1,111 moderate-size IPOs with non-seven percent spreads. On closer inspection, several of these 63 were ADRs of foreign firms that were misclassified by SDC, several were Canadian companies, 11 were IPOs where the spreads were lower than 7.0 percent, but the expected proceeds from the preliminary prospectus indicated an intention to raise at least $80 million, and five were IPOs where the spreads were higher than 7.0 percent, but the expected proceeds from the preliminary prospectus was less than $20 million. (The spread is generally negotiated before the preliminary prospectus is issued.) This leaves only about 40 out of 1,111 moderate-size IPOs with non-seven percent spreads. Thus, in 1995-1998, the clustering of spreads at 7.0 percent is actually even more extreme than the 91 percent of moderate-size deals shown in Table 1. When the above reclassifications are made, it appears that at least 95 percent of IPOs with expected proceeds of $20-80 million paid 7.0 percent spreads.

Pricing Behavior of Individual Investment Bankers

Figure 3 shows that 91 percent of IPOs with proceeds of $20-80 million paid

exactly 7.0 percent as their underwriting spread in 1995-1998. To investigate the pricing behavior of the most active underwriters, I calculate the market share for each investment banker. The market share for each bank is defined as the sum of gross proceeds (in 1997 dollars) raised by the bank acting as the lead underwriter, divided by the sum of gross proceeds (in 1997 dollars) raised in all IPOs, during 1995-1998. Figure 8 displays the clustering behavior of the twelve IPO underwriters with the largest market shares.[7] It shows that the pricing behavior of these prominent investment bankers is quite uniform.

Spreads in Other Countries

Spreads on IPOs in other countries are much lower than in the U.S. For example, the March 19, 1997 IPO of Cambridge Antibody Technology in the United Kingdom, underwritten by Kleinwort, raised $66 million (U.S.) with a 3.36 percent spread (composed of a 3.0 percent commission plus a 150,000 pound fee), according to SDC.[8] In Japan, IPO spreads are typically in the range of 3-3.5 percent of proceeds for moderate-size deals. In Taiwan, spreads are even lower, although potential buyers of IPOs also pay a commission, unlike in the U.S.

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[7] The market shares in 1995-1998 are highly correlated with the market shares from earlier in the 1990s reported in Beatty and Welch (1996, Table 3).

[8] In 1998, the British government's Monopolies and Mergers Commission launched an inquiry into possible price-fixing on equity offerings in the U.K. (see *The Economist*, June 27, 1998). The focus of the British inquiry appears to be on the standard two percent fee that is charged for "sub-underwriting" seasoned equity offerings. In the U.K., seasoned equity offerings are typically rights offerings priced at a discount of about 10 percent to the market price, with the price set several weeks before the exercise date. The sub-underwriting fee is the price of the put option that the issuer has implicitly purchased. Plausible estimates of the put value are substantially less than two percent.

There are certainly differences in the regulations and associated costs for underwriting IPOs in different countries. One reason that is frequently advanced for higher costs of underwriting in the U.S. is the lawsuit potential. But the reality is that auditing firms and investment bankers have been successful in their strategy during the 1980s of fighting securities fraud lawsuits with such ferocity that plaintiffs attorneys usually do not even bother suing them anymore (see Beatty and Welch, 1996). Instead, directors and officers (D&O) insurance pays settlements in the typical securities class action lawsuit, with underwriters untouched.

Spreads on Small and Large IPOs

For deals below $20 million, spreads are typically even higher than 7.0 percent, as shown in Figure 7. This is consistent with substantial fixed costs in underwriting. Revenue must be sufficient to cover the cost of writing a prospectus and conducting a roadshow, as well as cover the costs of "busted" deals and the costs of prospecting for business. The conventional wisdom is that the large, prestigious investment banking houses have costs that are so high that they do not find it profitable to do these small deals, which are primarily sold to a retail, rather than an institutional, clientele. These small deals frequently include compensation for the underwriters that includes warrants to buy stock in the issuing company, in addition to the stated gross spread (see Barry et al., 1991). I do not analyze these small deals.

For large deals, which I define as IPOs with proceeds of $80 million or more, average spreads are below 7.0 percent, and there is little clustering. Inspection of Figures 5 and 6 shows that economies of scale are clearly displayed for these large IPOs: the bigger the deal, the lower the spread tends to be.

Spreads on Seasoned Equity Offerings

Given the clustering of IPO spreads, a natural question is whether the same pattern is observed for the spreads on seasoned equity offerings (SEOs). Figures 9 and 10 show the spreads on SEOs, also known as follow-on offerings, from 1998. Figure 9 for SEOs is analogous to Figure 6 for IPOs, showing spreads versus the natural logarithm of proceeds. Figure 10 for SEOs is analogous to Figure 7 for IPOs, showing spreads versus proceeds on deals below $100 million. Inspection of Figures 9 and 10 shows that there is a slight tendency to prefer spreads that are at integers or half-integers (4.5 percent, 5.0 percent, 5.5 percent, etc.), but that this tendency is fairly mild. Figure 9 suggests that there are economies of scale in conducting SEOs, with a nearly linear relation between the log of proceeds and spreads. Most importantly, there is no tendency to cluster on a single number for SEOs. For SEOs of a given size, there is considerable dispersion in the spreads paid on different deals. A comparison of the figures for IPOs and SEOs suggests that there is something special about 7.0 percent spreads when it comes to IPOs.

Summary

In sum, the facts show that there is pronounced clustering of gross spreads at exactly 7.0 percent for almost all IPOs raising $20-80 million. This concentration increased gradually during the 1980s and 1990s, to the point where in recent years well over 90 percent of moderate-size IPOs in the U.S. have paid 7.0 percent spreads. In other countries, spreads are substantially lower than in the U.S. The patterns suggest that gross spreads are competitive for deals below $20 to $30 million, but increasingly profitable on larger deals. There is no clustering on a single number that is observable for SEOs.

Explanations for High Spreads

At its most general level, this chapter is asking the following question: What features of the IPO market structure are conducive to an equilibrium in which fees are high?

When going public, an issuing firm typically conducts a "beauty contest" to choose a lead manager (also known as the book manager) and one or two co-managers. The conventional wisdom is that underwriter prestige and analyst reputation are of paramount importance in this decision. Underwriters do not commit to a specific offer price at the time an underwriting agreement is signed. Thus, competition on the basis of valuations is muted.

Analyst Coverage

An implicit understanding is that the managing underwriters of an IPO will each assign a securities analyst to cover the company and produce research reports and issue buy recommendations for the stock (see Power, 1993; Rajan and Servaes, 1997; Dunbar, 1998; Michaely and Womack, 1998). For a small firm (in 1998 a firm with a market capitalization of equity of $250 million is too small to be included in the Russell 2000), there is a presumption that the stock price is affected by analyst coverage and whether there are buy recommendations on the stock. "Buy" recommendations may be especially important after the lock-up provision has expired, and insiders want to sell some of their stock in the open market.[9] In other words, the objective function of managers at the time

[9] A lockup provision restricts pre-issue shareholders from selling shares while it is in effect, without the explicit written permission of the managing underwriter. A typical lockup provision is for 180 calendar days after the IPO.

of the offering includes raising money at the time of the offering, and raising money in future open-market insider sales. Other shareholders benefit, too, from the enhanced liquidity of their shares that is a consequence of the analyst coverage.

In the 1980s, many IPOs did not have co-managers. Today, almost all IPOs have one, two, three, or even more co-managers. A reason for this growth in the number of co-managers is that the issuing firm is essentially buying additional analyst coverage at no incremental expense (since the underwriting fees will be 7.0 percent of proceeds whether or not there are co-managers). In Table 3, I report the number of managers for moderate-size (Panel A) and large IPOs (Panel B). Panel A shows that in 1985-1987, 37 percent of moderate-size IPOs were solely managed, whereas in 1995-1998, only four percent were.

In Table 4, I report the number of analyst forecasts within one year of an IPO reported by I/B/E/S. In Panel C, I report two regressions where the number of analysts making an earnings forecast within a year of the IPO is the dependent variable. The top row reports the results of a pooled time series-cross section regression. The second row reports the average coefficients from a time series of thirteen regressions, each of which uses the IPOs from one calendar year during 1985-1997. The R^2 reported for this second regression is the average of the thirteen R^2 values, and the t-statistics are based upon the time-series standard deviation of the coefficients. Both regressions find that more analysts follow an IPO if it is larger, and if it has a higher first-day return. These results are consistent with Rajan and Servaes (1997, Table II). Of particular interest, however, is the finding that an incremental co-manager adds 0.36-0.55 net analysts, holding the proceeds and first-day return constant.

Securities analysts are beneficiaries of this system. Analysts with good

reputations (as measured, for instance, by the annual *Institutional Investor* magazine all-star rankings) can command a high salary and bonuses. Analysts who help bring in equity financing business also stand to receive large bonuses (Siconolfi, 1992; Smith, 1996; Raghavan, 1997). Krigman et al. (1998) report survey evidence that issuers cite analyst coverage as a main determinant for choosing underwriters.

The importance of analyst coverage represents a potential barrier to entry for new underwriters. Without having a well-regarded analyst, issuers will be skeptical about the ability of an underwriter to successfully tout the stock in the aftermarket, or place it initially. Furthermore, by emphasizing industry expertise, the IPO underwriting business becomes one of differentiated products, reducing the number of viable competitors for any given deal.

Underwriter Prestige

Underwriter prestige is a second important criterion for choosing managers. There is a perception that the "certification" of a prestigious underwriter is very valuable to an issuing firm. While underwriter prestige can and does change over time, the most prestigious underwriters today include Goldman Sachs, Morgan Stanley Dean Witter, and Merrill Lynch. As long as issuing firms choose a lead underwriter primarily on the basis of analyst and investment banker reputations, there is little incentive for underwriters to charge differential gross spreads, for the elasticity of demand is not high with respect to the fees charged. Competition to be a lead manager is thus focused on the intermediary's "quality" rather than the fees charged.

For intermediaries to have an incentive to certify the value of the item being sold, a stream of future quasi-rents must be anticipated (Beatty and Ritter, 1986; Booth and

Smith, 1986). Quasi-rents are the cash flows above marginal cost that can be viewed as a return on the prior investment in establishing a reputation. This framework would suggest that above-competitive spreads are needed to give underwriters an incentive to turn down deals that may be attractive in the short-run, but would be bad for investors in the long-run.

While above-competitive underwriter compensation is needed to induce investment bankers to perform a certification function, it is not clear why this should result in spreads of 7.0 percent for essentially all deals, whether they are $20 million or $80 million. Given the economies of scale that exist in the cost structure, the 7.0 percent pricing structure results in substantial profits on deals at the high end of the moderate-size range.

Underwriting Syndicates

Once an issuer chooses a book manager and co-managers, the lead manager invites other underwriters into the underwriting syndicate. Typically, the syndicate is split into several brackets (see Carter et al., 1998 for a description), depending upon how many syndicate members there are. Because the fees are shared among the syndicate members, at first glance the resulting revenue sharing might be viewed as conducive to a reduced competitive environment.

Historically, syndicates existed partly for regulatory capital requirement and risk-sharing purposes, and partly to facilitate the distribution of an issue. This was particularly relevant when the lead underwriter did not have a significant retail or institutional distribution network, and had limited capital. Today, there is little reason to form a syndicate to perform the traditional economic roles of risk sharing, distribution,

and meeting capital requirements. Not surprisingly, syndicate size as measured by the number of participating firms has fallen over time, even as the number of co-managers has grown. Underwriters such as Merrill Lynch, with their large institutional and retail distribution networks, do not need other investment bankers to assist in distributing a given issue. And with their large capital bases, risk sharing would seem to be important only for the very largest issues.

In recent years almost all IPOs have not only had a book manager, but also one or two co-managers. Table 5 presents a hypothetical example with Goldman Sachs as lead underwriter and BT Alex. Brown as the co-manager. We assume that there are thirteen other members of the underwriting syndicate, where the two managers underwrite 900,000 shares each, the seven members of the major bracket underwrite 100,000 shares each, and the six members of the submajor bracket underwrite 50,000 shares each. The total number of shares is 2,800,000, before a 15 percent overallotment option, and gross proceeds at a $12.00 offer price would be $33,600,000 net of the overallotment option. We assume a gross spread of 7.0 percent, which has three components, as shown in Panel A of Table 5. Of the 84 cent gross spread, we assume a selling concession of 48 cents, an underwriting fee of 19 cents, and a management fee of 17 cents.[10] A syndicate member would receive 48 cents for each share whose sale is attributed to that member. In general, there is no necessary relation between the number of shares underwritten and the

[10] A management fee goes to managing underwriters for managing the deal. An underwriting fee goes to managing underwriters and syndicate members for assuming the risk of purchasing securities from the issuer. A selling concession is given to managing underwriters, syndicate members, and selling group members for distributing securities to investors.

selling credits earned. Normally, the vast majority of the shares sold will be credited to the book manager, as illustrated in Panel B of Table 5. All 15 syndicate members would receive the underwriting fee of 19 cents per share, minus underwriting and stabilization expenses, for each share underwritten. The managing underwriters would receive 17 cents on every share sold by any member, with the split between the lead and co-managing underwriters usually tilted in the lead manager's favor.

In a typical IPO, the vast majority of revenue and profits goes to the book manager, as illustrated in Panel C of Table 5. The book manager receives at least a proportionate share of the management fee revenue, the majority of the selling concession revenue, and part of the net underwriting fee revenue. This last item is typically a small number, and may even be negative if stabilization expenses are high.

There are certain ongoing expenses that lead and co-managers have, such as the pay of analysts and corporate finance employees, so the revenue figures are not the same as profit figures. Furthermore, part of the revenue is merely a competitive return on the capital required by regulators to underwrite securities. But the example in Table 5 shows how lucrative it can be to be a lead manager or co-manager on a large IPO. Thus, although the fees are shared among syndicate members, there is still fierce competition to be a lead manager.

It is noteworthy that new entrants to the IPO underwriting market have not tried to gain market share by cutting spreads. The two most prominent new entrants in IPO underwriting in the 1990s have been Deutsche Bank Securities (formerly Deutsche Morgan Grenfell (DMG)) and Friedman Billings Ramsey. Both firms have charged 7.0 percent spreads on moderate-size IPOs in the mid-1990s.

The Cost of Price Support

Underwriters frequently stabilize, or support, the price of an IPO immediately after it has gone public. Price support involves the practice of being a net buyer of shares, which are retired if the underwriter overallocated the issue. An implicit commitment to stabilize an IPO can be viewed as the underwriter writing a put option with an exercise price equal to the offer price. The anticipated value of this put option is, in principle, one of the determinants of gross spreads. The value of this put option can be reduced by decreasing the offer price relative to the expected aftermarket price. Thus, if spreads were lower, underwriters might be tempted to set lower offer prices, in order to reduce the value of the puts that they are writing. The indirect cost of this underpricing might be far larger than the savings in direct costs on the spreads.

A desire by issuers to reduce the amount of money left on the table by paying high spreads is plausible. This does not explain, however, why there should be clustering at 7.0 percent. Furthermore, an issuer which wanted to increase incentives for stabilization could insist on a change in the components of the gross spread, reducing the selling concession and/or management fee, and increasing the underwriting fee. In any case, Aggarwal (1998) reports that empirically the costs of stabilization to underwriters are relatively small.

Spreads Signal High Quality Underwriting

In many other markets, such as medical specialties, consulting, and legal advice, professionals find that charging a low price for their services signals lower quality, and results in lost business. This phenomenon is present in markets where clients are unable to easily evaluate quality on either an *ex ante* or *ex post* basis, and where repeat dealings

are uncommon. In these markets, sellers of services tend to charge high prices and at least some market participants have excess capacity (which they attempt to hide because its existence might signal low quality). An underwriter charging a low fee might raise concerns about its willingness to engage in price stabilization, provide analyst coverage, exercise care in helping to write a prospectus, aggressively market a deal, etc. The quality of all these underwriting services is difficult to contractually specify, and difficult to evaluate. As a result, in equilibrium, no underwriter charges a lower fee because the lower fee will not generate additional clients.

IPO underwriting seems to share many of the characteristics of markets where price signals quality. But while any given firm will generally go public just once, limiting repeat business and learning, this is too myopic a view. Reputation effects overcome some of the information asymmetries: if Goldman Sachs decided to cut its spreads, few issuers would suspect that it had become a low-quality underwriter.

Explanations for the Clustering of Spreads at Seven Percent

Explicit Collusion

One possible explanation for the clustering of spreads at 7.0 percent is collusion. If underwriters compete for business on the basis of spreads that they charge, competition will drive the spread on any given deal to the cost of providing the services, including compensation for expected risks that are borne by the underwriter. If underwriters agree to form a cartel, they can increase their profits. On every deal, a mechanism to decide how much to charge would be needed. One possible arrangement is to agree to always charge the same fees (7.0 percent), with the profits shared. The existence of syndicates

would seem to be an excellent way to share the profits.

With literally scores of people involved in setting spreads at different investment banking firms, the ability to explicitly collude and keep it a secret strains credibility. Legal liability is also a deterrent.[11] And while underwriting syndicates could in principle be used for sharing profits, in practice the lead underwriter grabs the lion's share of profits.

Implicit Collusion

While explicit collusion is difficult to coordinate, it is possible that investment bankers are of the opinion that if they compete aggressively on the basis of fees, spreads will be driven down to the point where there will be little money for year-end bonuses for the individuals involved. Thus, the individuals involved may act strategically to avoid turning IPO underwriting into a "commodity business." Implicit collusion requires that each underwriter realizes that high spreads result in lots of money for year-end bonuses that would be jeopardized if spreads get driven down to competitive levels due to cutthroat competition. As long as the present value of the future cash flows resulting from high spreads is greater than the short-term gains associated with undercutting the competition to win a deal, each underwriter will avoid cutting its spread.

The logic behind the implicit collusion explanation for high spreads can be formalized in a noncooperative dynamic game (see Chapter 3), based on the Dutta and Madhavan (1997) model. With IPOs, it is quite plausible that underwriters fear that

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[11] NASD *Notice to Members 98-88,* issued in October 1998, reminds underwriters that there is no standard level of underwriter compensation, and that coordination among members on the gross spreads charged is explicitly prohibited. This notice is partly motivated by the pattern of clustering at 7.0 percent spreads on IPOs.

quoting a lower spread will set off a price war that will drive gross spreads down on future deals. After all, many individuals in the business state that they do not want to charge a lower spread because they "don't want to turn it into a commodity business." It is hard to think of stronger evidence to support the proposition that the participants are thinking strategically. In other words, they are forecasting the spreads that will prevail in the future based upon what is done today, and acting accordingly. Thus, each underwriter may decide to keep its spread above competitive levels, even without explicit collusion.

The implicit collusion argument also offers an explanation for why the spreads on deals above $80 million are generally lower than 7.0 percent. Since there are economies of scale in the costs of underwriting IPOs, deals above $40 or $50 million are for the most part extremely profitable at a 7.0 percent spread. If the profits on a deal are too large, each underwriter has an incentive to undercut the competition, even if it means jeopardizing all of the future profits from high spreads. In order to forestall a price war from breaking out, underwriters must limit the economic profits earned on any given deal to a "reasonable" level (see Rotemberg and Saloner, 1986; Dutta and Madhavan, 1997; Chapter 3). Beyond a certain level of proceeds size, spreads of 7.0 percent are unsustainable.

The implicit collusion explanation for high average fees and clustering at 7.0 percent raises the following question: Why, since sellers in every industry prefer high prices to low prices, is an implicit collusion equilibrium sustainable with IPO spreads and not in most other businesses? The answer is that customers view the fees charged as just

one of a set of characteristics on which to choose an underwriter.[12] If customers were more focused on fees, the implicit collusion equilibrium would be harder to sustain relative to the competitive equilibrium.

Resolving Agency Costs with Multiple Principals

There are many other markets for intermediary services which display strong clustering of fees at integers. Probably the most obvious example is brokerage commissions on residential real estate, where in many cities, almost all transactions are done at 6.0 percent. The real estate market involves both listing agents (representing sellers) and buying agents. Each property has a vector of characteristics and different buyers have different tastes, resulting in a time-intensive matching problem. In real estate, agents representing buyers observe the fees being offered on a property through the multiple listing service books, and they will steer clients away from properties that do not compensate the agents well. Because real estate agents are representing multiple clients, charging a uniform commission eliminates the incentive of agents to spend a disproportionately low amount of effort on properties offering lower commissions (Williams, 1998). Also, there is less homogeneity of real estate percentage fees than it appears. In fact, real estate fees can be negotiated in two ways. First, on properties that *ex ante* appear easy to sell, a seller can get a listing agent to rebate part of the listing fee. Second, when a buyer makes a bid on a property, the seller can respond with a reservation price (net of commission) where the difference is too small to give the brokers their full

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[12] Krigman et al. (1998) report survey evidence that several factors are often considered important when issuers choose underwriters. Those factors include underwriter's reputation and status, underwriter's industry expertise and connections, and quality and reputation of analysts.

commission. Rather than start all over with a new buyer or a new house, the agents can be *ex post* "squeezed." In other words, there is a hold-up problem.

There are several important distinctions between the markets for intermediaries in real estate and for IPOs. With financial securities, the objective function of both buyers and sellers is dependent primarily upon a single attribute, the cash payoffs. So unlike real estate, there is not a time-intensive problem of matching desired characteristics. Thus, a uniform commission so that one client is not favored over another client is not needed with IPOs.

Other Components of Compensation

If underwriter compensation is composed of more than just the spread, the clustering of spreads at 7.0 percent may give a misleading view of the degree of clustering of the total compensation. On small offerings, underwriter warrants, "nonaccountable expense allowances," and other additional underwriter compensation is common. But for deals above $20 million, industry practice is to have the gross spread represent all of the underwriter's compensation. Inspection of a random sample of prospectuses in 1997 for IPOs with proceeds of $20-25 million found no cases of nonaccountable expense allowances boosting underwriter compensation. It should also be noted that almost all IPOs have a 15 percent overallotment option, so there is almost no time-series or cross-sectional variation on this dimension.

One dimension on which there is substantial cross-sectional variation, however, is the degree of short-run underpricing. On average, the first-day return on IPOs is 10-15 percent (see Lee et al., 1996, for example), which is an indirect cost of going public. The first-day returns represent profits to investors (and an opportunity cost to issuers) that are

approximately twice as large as the direct fees received by underwriters. For example, on a $40 million IPO with a 7.0 percent spread and a first-day return of 14 percent, the direct fees are $2.8 million, and the money "left on the table" is $5.6 million. In this example, investment bankers have $5.6 million in profits to hand out to favored clients, such as clients who are willing to overpay for other services.

Since in the U.S. the offer price is typically not set until the day before trading commences, *ex ante* negotiation of the gross spread does not eliminate the potential for hold-up problems. This is because the number of shares and the offer price are not negotiated until after almost all costs (other than stabilization costs) are sunk. Because it is thus not clear whether the *ex ante* or *ex post* proceeds should be used to examine whether there is a substitution between spreads and underpricing, I report results both ways.

In Table 6, I divide the IPOs from 1985-1998 into three subperiods and proceeds categories based upon (i) the actual gross proceeds (Panel A), and (ii) the expected gross proceeds, calculated using the midpoint of the file price range (Panel B). Within each category, I then report the average first-day return for IPOs with spreads (i) below 7.0 percent, (ii) equal to 7.0 percent, and (iii) above 7.0 percent. Visual inspection of Panels A and B fails to find any obvious monotonic tradeoff between the spread and average first-day returns. One pattern that does emerge, however, is the higher underpricing during 1995-1998 than during 1985-1987.

In Panel C, I report pooled cross section-time series regression results for moderate-size IPOs with the percentage first-day return as the dependent variable. The explanatory variables include the logarithm of actual gross proceeds, the percentage offer

price revision, a dummy for a gross spread below 7.0 percent, a dummy for a gross spread above 7.0 percent, and yearly fixed effects dummy variables. Consistent with Hanley's (1993) empirical work on partial adjustment, revisions in the offer price reliably predict the first-day return. For both the entire 14 year sample period, and for the 1995-1998 subperiod, IPOs with spreads above or below 7.0 percent have a lower first-day return than those with spreads of exactly 7.0 percent, although the patterns are not always statistically reliable. The lower first-day return on IPOs with low spreads is consistent with the hypothesis that lower spreads are found on low-risk (and hence low-return) IPOs. Though the negative coefficients on the dummy variables for above 7.0 percent spreads are consistent with the notion that reduced underpricing is a substitute for a high spread, the statistical significance is not present in the subperiod.

Another form of compensation for the lead underwriter is the profits from future market making activity. Ellis et al. (1998) report that the lead underwriter usually is the most active market maker in the first sixty days of post-IPO trading for a sample of 312 Nasdaq-listed IPOs from 1996-1997. They calculate that the lead underwriter makes money on this market making activity, although the numbers are modest relative to the fees from the gross spread.

There is no regulatory constraint that forces spreads to equal 7.0 percent. National Association of Securities Dealers (NASD) Rule 2710 prohibits a member from participating in a public offering with unfair or unreasonable underwriter compensation, where NASD Regulation's Corporate Financing Department has direct responsibility for the review of underwriter compensation. There is no evidence that this rule is a binding constraint for these moderate-size and large IPOs.

Resale Price Maintenance

As discussed in Section 3, the conventional wisdom is that future analyst coverage is an important consideration for firms going public. Thus, investment bankers are intermediaries who are selling a bundle of services: the IPO underwriting itself, and future analyst coverage. By paying above-competitive underwriting fees, issuing companies induce underwriters to offer more analyst coverage in their attempt to compete for the profitable business. The logic is the same as that of the "resale price maintenance" literature, where a producer wants distributors to offer a minimum service level (Telser, 1960). By setting a minimum price at which the products can be resold, the producer induces the intermediaries to offer more services than they otherwise would.

While high spreads on average can be viewed as compensation for inducing underwriters to provide future analyst coverage, this does not explain why 7.0 percent spreads on $80 million deals are the norm, just as they are on $20 million deals. The clustering at 7.0 percent for almost all deals within a very large range of proceeds suggests that the larger and safer deals are providing substantial economic profits to the underwriters involved.

Presumably, some issuers would prefer to pay high fees and "purchase" a high level of services. Other issuers would prefer fewer services in return for lower fees. But the lack of dispersion of spreads suggests that this choice is not available to issuers.

Cross-subsidization

One possible reason for the clustering of spreads at 7.0 percent is that underwriters have difficulty knowing their exact costs on a given deal, and they price their services in a manner whereby some issuers subsidize other issuers. As long as

underwriters break even on average, there is little reason to change this policy. The problem with this argument is that, given the economies of scale that exist, it does not take a rocket scientist to realize that $80 million deals are more profitable than $20 million deals if the percentage spread is the same on both. An underwriter could increase its profitability by concentrating on the larger deals.

Possible Reasons for the Increased Clustering of Spreads over Time

As shown in Table 1 and Figures 1-4, the clustering of spreads has increased substantially in the last decade. This raises the question, why?

One possibility is that, as in almost all markets, learning has occurred over time. In the mid and late 1970s, IPO volume in the U.S. (and almost all other countries) was virtually nonexistent, with the number of deals per *year* less than the number in many *weeks* during the 1990s. As IPO volume picked up in the 1980s, four boutiques (L.F. Rothschild, Unterbeg, Towbin; Robertson Stephens; Hambrecht & Quist; and Alex. Brown) specializing in IPO underwriting captured a large share of a growing market. In the early 1980s, "bulge bracket" investment bankers such as Goldman Sachs, Morgan Stanley, and Merrill Lynch did relatively few IPOs. By the mid-1980s, the bulge bracket firms started to get more involved, and L.F. Rothschild went out of business after a falloff in IPO volume after the 1987 market crash.

In the 1980s, there was more heterogeneity of spreads, less concentration of underwriters, and sole managers were more common. While the average spread on IPOs has not changed, even as clustering has increased, this is not evidence that spreads are at competitive levels. In many related markets, such as the fees on mergers and

acquisitions, investment banker fees have fallen from the mid-1980s to the mid-1990s. The fact that IPO spreads have not fallen is consistent with the existence of a market structure that is conducive to implicit collusion.

Several other reasons may explain the increased clustering over time. First, precedent is important. It is easier to justify a given spread to a client if an underwriter can point to other recent deals at the same (or higher) spread. Charging a higher than 7.0 percent spread might have become increasingly unattractive as competitors used it to dissuade a potential client from going with an expensive underwriter. Also, in the 1980s it may have been more common to negotiate the spread at the pricing meeting immediately before an offering, at the same time that the offering price and number of shares to be issued are negotiated (see Uttal, 1986 for a description of the negotiation of the spread in the Microsoft IPO).

Summary and Conclusions

This chapter presents evidence of the clustering of gross spreads on IPOs at 7.0 percent, with the concentration of 7.0 percent spreads increasing during the 1990s. For offerings with proceeds of $20-80 million (in dollars of 1997 purchasing power), at least 90 percent of IPOs during 1995-1998 had spreads of exactly 7.0 percent. For comparison, only 26 percent of moderate-size IPOs in 1985-1987 had 7.0 percent spreads. There is widespread agreement that fixed costs exist in underwriting IPOs, yet investment bankers charge the same 7.0 percent spread on $20 million deals as they do on $80 million deals. The average spread on IPOs has remained virtually constant during the 1985-1998 period, in contrast to declining fees for mergers and acquisitions, etc. Spreads

on U.S. IPOs are roughly twice as high as in other countries.

I argue that for most IPOs with gross proceeds larger than $30 million, spreads are above competitive levels in the U.S. The high average spread and the concentration of spreads at 7.0 percent is consistent with implicit collusion on the part of investment bankers. In other words, even though investment bankers are acting independently, average spreads are above competitive levels. Several features of the IPO underwriting market are conducive to spreads above competitive levels. The importance of analyst coverage and buy recommendations, and the perceived importance of underwriter prestige, facilitate high spreads.

If gross spreads are above competitive levels, investment bankers have an incentive to use nonprice competition to attract deals. Although issuing firms face high and, for moderate-size deals, nonnegotiable spreads, issuers can still bargain on another dimension. In particular, by insisting on additional co-managers, issuing firms receive more extensive analyst coverage. I show that the number of co-managers has increased over the last decade, and that adding an additional co-manager adds between 0.36 and 0.55 net analysts following the stock. Highly ranked analysts have benefited, as their compensation has been bid up as underwriters use the implicit promise of favorable coverage and buy recommendations to compete for business. Investment bankers are also able to use analyst coverage as a means for product differentiation, relaxing price competition. There is a further aspect to industry specialization by analysts that is relevant. To the degree that the only underwriters that would be viable competitors are those with a well-regarded analyst, an investment banker that undercuts spreads on IPOs in one industry cannot expect to gain market share in IPOs from other industries. To the

degree that the broader market is split into sub-markets, the gains from undercutting the spread for an underwriter are limited to the submarket, increasing the sustainable spread (see Dutta and Madhavan, 1997, pp. 260-261). In this respect, industry specialization by investment bankers is analogous to payment for order flow on Nasdaq stocks.

The evidence is consistent with the implicit collusion explanation. Investment bankers realize that if one investment banker tries to win business by cutting spreads, the underwriting industry is likely to move to an equilibrium with low spreads, and lower compensation for corporate finance employees.

With approximately $40 billion per year in IPO volume in recent years, if spreads on average have been one percent too high, issuing firms have paid excess investment banking fees of $400 million per year. If spreads are above competitive levels, it is clear that analysts and corporate finance specialists at investment banking firms have benefited. But who has been hurt? To the degree that investors have incorporated excessive fees into their forecasts of future corporate expenses, and priced the securities appropriately, they have not been hurt. But the founders of the companies, and the founders of other companies that might have gone public but never did, have suffered because the costs of raising external capital are excessive.

In contrast to the pattern for IPOs, there is little clustering of spreads on follow-on offerings, and economies of scale are evident for all proceeds sizes. There is some evidence that gross spreads on follow-on offerings have come down a little in recent years (see Beatty et al., 1998; Gande et al., 1998). Trade journals have attributed this to competition from commercial banks, which are trying to enter the underwriting business. It remains to be seen how big an impact this has on the gross spreads on follow-on

offerings, and whether this competition has any effects on the gross spreads on IPOs. In the year after Nationsbank, Bankers Trust, BankAmerica, and BancBoston bought investment banking firms that specialized in IPOs, there does not seem to have been any impact in the IPO market. Another source of competition may emerge from the innovation of internet technology. For example, new underwriters E*Offering and W. R. Hambrecht threaten to undercut the 7.0 percent fee that is now standard.[13] Only time will tell whether this changes the gross spreads that prevail in the IPO underwriting industry.

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[13] See the *Wall Street Journal* article by Buckman (1999) and the article of *Fortune* magazine by Tully (1999).

Table 1: Number of IPOs by Year, Proceeds, and Gross Spread, 1985-1998

The sample consists of 3,203 firm commitment initial public offerings (IPOs) with proceeds of at least $20 million before the exercise of the overallotment option. Securities Data Co. is the source of the data. Closed-end funds, REITs, ADRs, and unit offerings are excluded. The amount of proceeds is expressed in terms of dollars of 1997 purchasing power, using the U.S. GDP implicit price deflator. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%.

Year	Proceeds (Millions)	Gross Spread			
		Below 7%	7%	Above 7%	All
1985	20-79.99	38	18	22	78
	80-up	16	1	3	20
	All	54 (55%)	19 (19%)	25 (26%)	98 (100%)
1986	20-79.99	92	38	51	181
	80-up	42	8	8	58
	All	134 (56%)	46 (19%)	59 (25%)	239 (100%)
1987	20-79.99	51	49	39	139
	80-up	29	4	3	36
	All	80 (46%)	53 (30%)	42 (24%)	175 (100%)
1988	20-79.99	16	22	10	48
	80-up	13	3	0	16
	All	29 (45%)	25 (39%)	10 (16%)	64 (100%)
1989	20-79.99	13	32	8	53
	80-up	13	2	0	15
	All	26 (38%)	34 (50%)	8 (12%)	68 (100%)
1990	20-79.99	13	37	14	64
	80-up	12	0	0	12
	All	25 (33%)	37 (49%)	14 (18%)	76 (100%)
1991	20-79.99	26	109	27	162
	80-up	46	2	0	48
	All	72 (34%)	111 (53%)	27 (13%)	210 (100%)
1992	20-79.99	25	155	18	198
	80-up	62	4	1	67
	All	87 (33%)	159 (60%)	19 (7%)	265 (100%)
1993	20-79.99	26	223	18	267
	80-up	68	10	0	78
	All	94 (27%)	233 (68%)	18 (5%)	345 (100%)
1994	20-79.99	18	153	16	187
	80-up	35	5	0	40
	All	53 (23%)	158 (70%)	16 (7%)	227 (100%)
1995	20-79.99	14	248	12	274
	80-up	53	12	0	65
	All	67 (20%)	260 (77%)	12 (3%)	339 (100%)
1996	20-79.99	21	348	14	383
	80-up	74	26	2	102
	All	95 (20%)	374 (77%)	16 (3%)	485 (100%)
1997	20-79.99	15	256	16	287
	80-up	59	30	1	90
	All	74 (20%)	286 (76%)	17 (4%)	377 (100%)
1998	20-79.99	6	158	3	167
	80-up	45	23	0	68
	All	51 (22%)	181 (77%)	3 (1%)	235 (100%)

Table 1. Continued

	20-79.99	181 (46%)	105 (26%)	112 (28%)	398 (100%)
1985-87	80-up	87 (76%)	13 (12%)	14 (12%)	114 (100%)
	All	268 (52%)	118 (23%)	126 (25%)	512 (100%)
	20-79.99	137 (14%)	731 (75%)	111 (11%)	979 (100%)
1988-94	80-up	249 (90%)	26 (10%)	1 (0%)	276 (100%)
	All	386 (31%)	757 (60%)	112 (9%)	1255 (100%)
	20-79.99	56 (5%)	1010 (91%)	45 (4%)	1111 (100%)
1995-98	80-up	231 (71%)	91 (28%)	3 (1%)	325 (100%)
	All	287 (20%)	1101 (77%)	48 (3%)	1436 (100%)

Table 2: Average Gross Spreads (%) by Year and Size of IPOs, 1985-1998

The sample consists of 3,203 firm commitment initial public offerings (IPOs) in 1985-1998 with proceeds of at least $20 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The amount of proceeds is expressed in terms of 1997 dollars, using the U.S. GDP implicit price deflator. IPOs with proceeds of at least $20 million but less than $80 million are designated as moderate-size IPOs, others are designated as large IPOs. VW spread denotes value-weighted spread with proceeds being the weight. EW spread denotes equally weighted spread. Numbers in parentheses represent the standard deviation.

	Moderate-size IPOs		Large IPOs		All IPOs	
Year	VW spread	EW spread	VW spread	EW spread	VW spread	EW spread
1985	6.88	6.96	6.08	6.38	6.40	6.84
		(0.47)		(0.64)		(0.56)
1986	6.89	6.94	5.83	6.33	6.20	6.79
		(0.40)		(0.71)		(0.56)
1987	6.96	7.00	5.55	6.08	6.04	6.82
		(0.40)		(0.80)		(0.63)
1988	6.85	6.92	6.01	6.14	6.33	6.72
		(0.27)		(0.64)		(0.52)
1989	6.95	6.97	5.89	6.16	6.30	6.80
		(0.12)		(0.59)		(0.45)
1990	6.99	7.03	5.83	5.98	6.45	6.86
		(0.43)		(0.62)		(0.60)
1991	6.99	7.01	5.82	6.03	6.28	6.79
		(0.18)		(0.80)		(0.58)
1992	6.99	7.01	5.78	6.04	6.24	6.77
		(0.26)		(0.57)		(0.56)
1993	6.98	6.99	5.75	6.14	6.23	6.80
		(0.16)		(0.59)		(0.47)
1994	6.94	6.97	5.94	6.09	6.44	6.82
		(0.21)		(0.53)		(0.45)
1995	6.98	6.98	5.82	6.15	6.34	6.82
		(0.13)		(0.63)		(0.44)
1996	6.98	6.99	5.74	6.38	6.27	6.86
		(0.15)		(0.63)		(0.41)
1997	6.95	6.98	6.01	6.36	6.37	6.83
		(0.30)		(0.70)		(0.50)
1998	6.97	6.98	5.05	6.14	5.52	6.74
		(0.18)		(0.92)		(0.64)

Table 3: Trend in the Number of Managers in Underwriting Syndicates, 1985-1998

The sample consists of 3,203 firm commitment IPOs in 1985-1998 with proceeds of at least $20 million (1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. IPOs with proceeds of at least $20 million but less than $80 million are designated as moderate-size IPOs, others are designated as large IPOs. If there is a sole manager on a deal, the number of managers is one. If there is one co-manager on a deal, the number of managers is two.

Years		Number of Managers					Mean # of Managers	Median # of Managers
		1	2	3	4 or more	All		
Panel A: Moderate-size IPOs								
	N	146	184	55	13	398	1.9	2
1985-1987	% of IPOs	37%	46%	14%	3%	100%		
	% of Proceeds	36%	44%	16%	4%	100%		
	N	137	648	182	12	979	2.1	2
1988-1994	% of IPOs	14%	66%	19%	1%	100%		
	% of Proceeds	12%	65%	21%	2%	100%		
	N	46	581	415	69	1,111	2.5	2
1995-1998	% of IPOs	4%	52%	38%	6%	100%		
	% of Proceeds	4%	47%	41%	8%	100%		
	N	329	1413	652	94	2,488	2.2	2
All	% of IPOs	13%	57%	26%	4%	100%		
	% of Proceeds	12%	53%	30%	5%	100%		
Panel B: Large IPOs								
	N	12	48	22	32	114	2.9	2
1985-1987	% of IPOs	11%	42%	19%	28%	100%		
	% of Proceeds	8%	32%	22%	38%	100%		
	N	27	86	93	70	276	2.9	3
1988-1994	% of IPOs	10%	31%	34%	25%	100%		
	% of Proceeds	8%	26%	29%	37%	100%		
	N	5	47	107	166	325	3.8	4
1995-1998	% of IPOs	1%	15%	33%	51%	100%		
	% of Proceeds	1%	8%	25%	66%	100%		
	N	44	181	222	268	715	3.3	3
All	% of IPOs	6%	25%	31%	38%	100%		
	% of Proceeds	5%	18%	26%	51%	100%		

Table 4: Analyst Following by Offering Size, Subperiod and Number of Managers in the Underwriting Syndicate, and Regression Analysis, 1985-1997

The sample consists of 2,911 firm commitment IPOs in 1985-1997 with proceeds of at least $20 million before the exercise of the overallotment option and covered by I/B/E/S. The analyst following information is from I/B/E/S. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The amount of proceeds is expressed in terms of 1997 dollars, using the U.S. GDP price deflator. IPOs with proceeds of at least $20 million but less than $80 million are designated as moderate-size IPOs, others are designated as large IPOs. Panel A and B report the summary statistics of analyst following. Number of full coverage represents number of IPOs in which all managers issue earnings forecasts within one year after the offering. The first row in Panel C reports the results of pooled cross-sectional and time-series regression analysis. The amount of proceeds is measured in millions of dollars. The sample size is reduced because of the requirement of first-day return which is defined as the percentage return form the offering price to the closing price of the first trading day. Numbers in parentheses are t-statistics calculated using White (1980) robust standard errors. The second row reports average parameter values from yearly cross-sectional regressions using the approach of Fama and MacBeth (1973).

		Number of Managers				
Years		1	2	3	4 or more	All
Panel A: Moderate-size IPOs						
1985-1987	1. Number of IPOs	133	177	52	12	374
	2. Number of Full Coverage	94	106	13	0	213
	3. Mean Manager Forecasts	0.71	1.45	1.90	1.50	1.25
	4. Mean Unaffiliated Forecasts	1.75	2.00	1.96	1.67	1.90
1988-1994	1. Number of IPOs	131	647	181	12	971
	2. Number of Full Coverage	114	569	126	6	815
	3. Mean Manager Forecasts	0.87	1.86	2.60	3.17	1.88
	4. Mean Unaffiliated Forecasts	1.68	1.96	2.18	6.92	2.03
1995-1997	1. Number of IPOs	40	517	332	46	935
	2. Number of Full Coverage	31	480	287	27	825
	3. Mean Manager Forecasts	0.77	1.92	2.86	3.39	2.28
	4. Mean Unaffiliated Forecasts	1.27	1.39	1.61	2.41	1.51
Panel B: Large IPOs						
1985-1987	1. Number of IPOs	11	46	19	31	107
	2. Number of Full Coverage	8	28	4	3	43
	3. Mean Manager Forecasts	0.73	1.48	1.37	2.16	1.58
	4. Mean Unaffiliated Forecasts	3.82	5.30	2.79	2.90	4.01
1988-1994	1. Number of IPOs	27	85	92	68	272
	2. Number of Full Coverage	26	70	60	31	187
	3. Mean Manager Forecasts	0.96	1.80	2.48	3.44	2.36
	4. Mean Unaffiliated Forecasts	6.44	4.06	4.78	5.24	4.83
1995-1997	1. Number of IPOs	4	40	85	123	252
	2. Number of Full Coverage	3	38	60	63	164
	3. Mean Manager Forecasts	0.75	1.95	2.64	3.81	3.07
	4. Mean Unaffiliated Forecasts	2.00	2.97	3.89	3.58	3.56

Table 4. Continued

Panel C: Dependent Variable: Number of Forecasts within One Year After IPO

	Intercept	Ln(Proceeds)	Number of Managers	First-day Return (%)	Adjusted R^2	Sample Size
Pooled CS-TS	-4.36 (-8.05)	1.84 (10.69)	0.55 (3.63)	0.02 (5.88)	0.210	2,844
Fama-MacBeth	-4.02 (-6.92)	1.84 (12.61)	0.36 (1.74)	0.05 (3.99)	0.227	13

Table 5: How the Fees Are Shared in a Typical Syndicate

This table presents a representative example of an IPO, showing how the shares being sold are allocated to the members of the syndicate for the purpose of compensating them. Most of the information contained here would be publicly disclosed, but the split of the management fee between the book manager (lead manager) and the co-manager is not publicly disclosed. The net underwriting fee is also not publicly disclosed. In Panel C, it is assumed that the overallotment option is exercised in full, with the number of shares underwritten increased by 15 percent above the Panel A numbers for all syndicate members.

Panel A: Underwriting information contained in prospectus and registration statement

Gross proceeds:	$33.6 million
Offer price:	$12.00 per share
Shares offered:	2,800,000 (plus 15% overallotment option of 420,000 shares)
Gross spread:	84 cents (7 %) $2,704,800 total including overallotment option
Management fee:	17 cents (by convention, 20% of gross spread, rounded up to the nearest penny)
Underwriting fee:	19 cents
Selling concession:	48 cents

Underwriting	Number of shares underwritten
Goldman Sachs (book manager)	900,000
BT Alex Brown (co-manager)	900,000
Bear Stearns	100,000
Deutsche Bank Securities	100,000
Donaldson Lufkin Jenrette	100,000
Lehman Brothers	100,000
Merrill Lynch	100,000
Morgan Stanley	100,000
Salomon Smith Barney	100,000
BancBoston Robertson Stephens	50,000
CIBC Oppenheimer	50,000
A. G. Edwards	50,000
Friedman Billings Ramsey	50,000
Hambrecht & Quist	50,000
NationsBanc Montgomery	50,000
Total	2,800,000

Panel B: Allocation of shares

2,800,000	deal size
+420,000	overallotment option
3,220,000	
-100,000	10% of non-managing underwriters' underwriting commitment (initial retention)
-700,000	managers' initial retentions (which are attributed to the book manager and co-manager on an un-even basis, possibly a 70-30 split, as assumed)
-50,000	to friends of the company (handled by lead manager)
-50,000	to company employees (handled by lead manager)
2,320,000	"institutional pot", allocated to institutional investors by book manager

Of the institutional pot, 30% gets allocated in this example evenly among the managers, and 70% is the "jump ball", or competitive portion, almost all of which will typically be attributed to the lead manager (let's assume 1,500,000 of the 1,624,000 shares in the jump ball). So the sales credits are as follows:

Lead:	490,000	from 70% of 700,000 initial retention
	50,000	from friends of company
	50,000	from company employees
	348,000	from 15% of institutional pot
	1,500,000	from jump ball
	2,438,000	
Co-manager:	210,000	from 30% of 700,000 initial retention
	348,000	from 15% of institutional pot
	50,000	from jump ball
	608,000	
Other underwriters:	100,000	from initial retention
	74,000	from jump ball
	174,000	

Panel C: Allocation of fees

Fees: underwriting fees of 19¢ x 3,220,000 = $611,800 minus assumed syndicate costs of $450,800 (including stabilization costs) = net of $161,000, or 5¢ per share

	Amount of revenue (net of $450,800 syndicate costs)				
Underwriter	Managers fees @ 17¢	Underwriting fees @ 5¢ net	Selling concession @ 48¢/share	Total	Shares credited
Lead	$273,700	$51,750	$1,170,240	$1,495,690	2,438,000
Co-manager	$273,700	$51,750	$291,840	$617,290	608,000
100,000 share bracket	0	$5,750	$8,352 on average	$14,102 on average	121,800 in total
50,000 share bracket	0	$2,875	$4,176 on average	$7,051 on average	52,200 in total

Table 6: Average First-day Returns by Offering Size, Subperiod, and Gross Spreads, 1985-1998

In Panel A, the sample consists of 3,122 firm commitment IPOs in 1985-1998 with actual proceeds of at least $20 million (in 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The first-day return is calculated as the percentage return from the offering price to the closing price of the first trading day. The number of IPOs is shown in parentheses. In Panel B, the sample consists of 3,271 firm commitment IPOs in 1985-1998 with expected proceeds (in 1997 purchasing power) of at least $20 million dollars. The amount of expected proceeds is computed using the midpoint of file price range multiplied by the number of shares quoted in the preliminary prospectus. Panel C reports regression results for IPOs with actual proceeds of at least $20 million but below $80 million. The amount of actual proceeds is measured in millions of dollars. Degree of offer price revision is defined as the percentage change from the midpoint of file price range to the final offer price. Numbers in parentheses are t-statistics using White (1980) robust standard errors. Coefficients for year dummy variables are reported at the bottom of the Panel.

		Amount of Proceeds (in millions of dollars)							
Years	Gross Spread	20-39.99		40-59.99		60-79.99		80-up	
Panel A: Actual Proceeds									
1985-1987	<7.0%	2.5%	(81)	4.5%	(52)	4.2%	(40)	6.2%	(79)
	=7.0%	6.6%	(73)	9.9%	(23)	5.1%	(3)	-0.3%	(13)
	>7.0%	7.3%	(92)	1.9%	(13)	-0.5%	(3)	0.7%	(12)
	All	5.5%	(246)	5.5%	(88)	3.9%	(46)	4.7%	(104)
1988-1994	<7.0%	8.5%	(43)	7.7%	(50)	7.5%	(40)	6.2%	(239)
	=7.0%	11.7%	(465)	16.6%	(191)	13.6%	(54)	11.3%	(24)
	>7.0%	11.6%	(88)	12.3%	(14)	10.7%	(8)	32.4%	(1)
	All	11.4%	(596)	14.6%	(255)	11.0%	(102)	6.8%	(264)
1995-1998	<7.0%	10.3%	(20)	6.3%	(11)	9.6%	(24)	12.3%	(226)
	=7.0%	18.5%	(581)	24.8%	(298)	21.0%	(123)	26.8%	(90)
	>7.0%	14.7%	(33)	21.9%	(9)	19.1%	(3)	9.1%	(3)
	All	18.0%	(634)	24.1%	(318)	19.1%	(150)	16.4%	(319)
Panel B: Expected Proceeds									
1985-1987	<7.0%	4.7%	(71)	3.1%	(63)	2.4%	(32)	5.2%	(80)
	=7.0%	6.1%	(78)	8.4%	(21)	4.0%	(4)	-0.4%	(14)
	>7.0%	5.0%	(97)	1.1%	(15)	1.6%	(3)	0.7%	(12)
	All	5.3%	(246)	3.9%	(99)	2.5%	(39)	3.9%	(106)
1988-1994	<7.0%	9.8%	(45)	9.1%	(50)	7.3%	(49)	5.5%	(228)
	=7.0%	12.5%	(528)	9.2%	(195)	5.6%	(49)	4.9%	(24)
	>7.0%	9.1%	(100)	7.7%	(20)	14.6%	(7)	0.0%	(0)
	All	11.8%	(673)	9.1%	(265)	7.0%	(105)	5.4%	(252)
1995-1998	<7.0%	9.3%	(19)	12.4%	(12)	10.5%	(25)	11.9%	(218)
	=7.0%	21.7%	(690)	17.9%	(272)	17.4%	(118)	9.1%	(75)
	>7.0%	8.5%	(36)	19.8%	(13)	17.6%	(4)	13.7%	(4)
	All	20.8%	(745)	17.8%	(297)	16.2%	(147)	11.2%	(297)

Table 6. Continued

Panel C: Dependent Variable: Percentage First-day Returns for Moderate-size IPOs

Sample Period	Logarithm of Actual Proceeds	Degree of Offer Price Revision (%)	Dummy for Gross Spread Below 7%	Dummy for Gross Spread Above 7%	Adjusted R^2	Number of Observations
1985-1998	-2.37 (-1.95)	0.60 (16.91)	-2.58 (-2.74)	-2.54 (-2.48)	0.24	2428
1995-1998	-2.99 (-1.29)	0.68 (11.86)	-7.62 (-2.99)	-3.15 (-1.22)	0.20	1100

(continued) Year	85	86	87	88	89	90	91	92	93	94	95	96	97	98
1985-1998	16.0	18.3	17.8	18.0	18.0	18.6	20.1	20.7	21.4	21.8	26.8	23.4	24.3	36.0
1995-1998											28.6	26.0	26.9	38.4

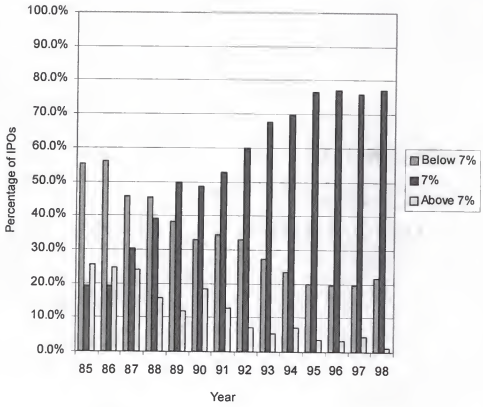


Figure 1. Gross spread distribution. The sample consists of 3,203 firm commitment IPOs from 1985 through 1998 with proceeds of at least $20 million (expressed in terms of dollars of 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%. The percentage of IPOs in each category are from Table 1.

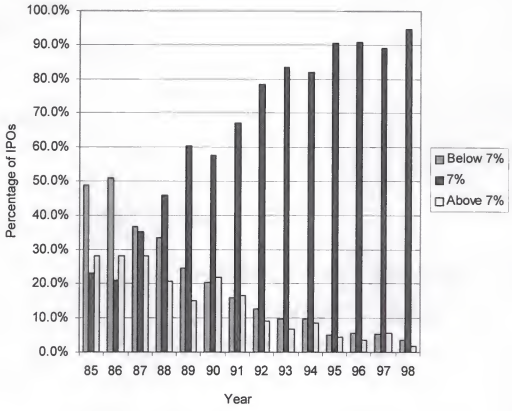


Figure 2. Gross spread distribution for moderate-size IPOs. The sample consists of 2,488 firm commitment IPOs from 1985 through 1998 with proceeds of at least $20 million but less than $80 million (expressed in terms of dollars of 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%. The percentage of IPOs in each category are from Table 1.

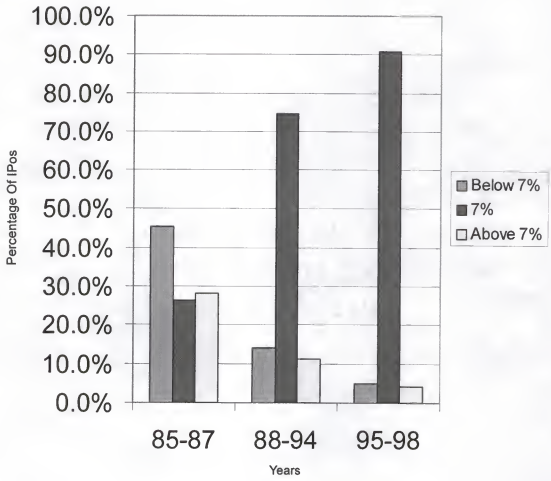


Figure 3. Gross spread distribution for moderate-size IPOs from 1985 through 1998. The sample consists of 2,488 firm commitment IPOs from 1985 through 1998 with proceeds of at least $20 million but less than $80 million (expressed in terms of dollars of 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%. The percentage of IPOs for each of the three periods are from Table 1.

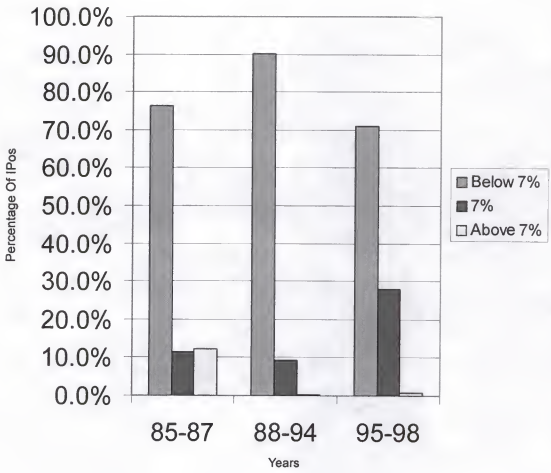


Figure 4. Gross spread distribution for large IPOs from 1985 through 1998. The sample consists of 715 firm commitment IPOs from 1985 through 1998 with proceeds of at least $80 million (expressed in terms of dollars of 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%. The percentage of IPOs for each of the three periods are from Table 1.

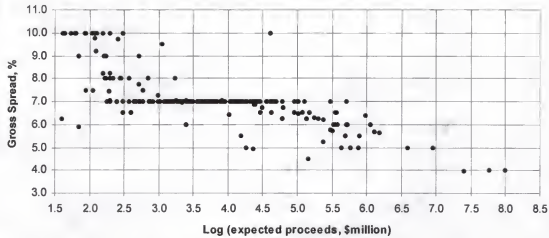


Figure 5. Scatter diagram relating IPO expected proceeds and gross spreads. The sample consists of 330 firm commitment IPOs in 1998 with actual proceeds of at least $5 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The amount of expected proceeds from the preliminary prospectus is measured in millions of dollars and then the natural logarithm is taken. Two IPOs with spreads of 11.11% and 2.97% are not shown in the diagram. A $20 million IPO has a log of 3.00, and an $80 million IPO has a log of 4.38.

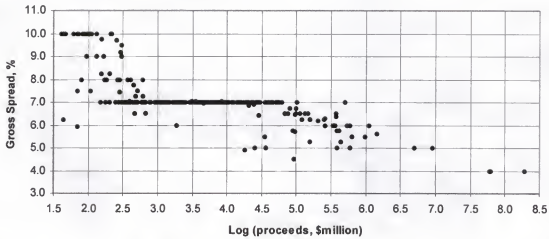


Figure 6. Scatter diagram relating actual proceeds and gross spreads. The sample consists of 330 firm commitment IPOs in 1998 with nominal proceeds of at least $5 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The amount of proceeds is measured in millions of dollars and then the natural logarithm is taken. Two IPOs (with proceeds of $5.0 million and $1.3 billion) with spreads of 11.11% and 2.97% are not shown in the diagram. A $20 million IPO has a log of 3.00, and an $80 million IPO has a log of 4.38.

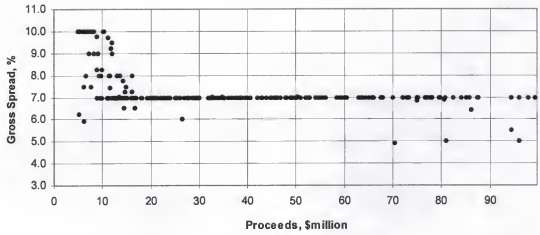
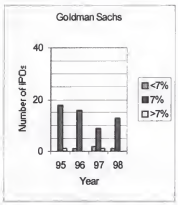
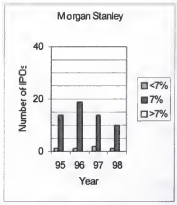


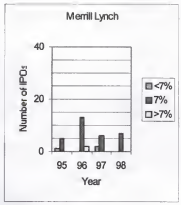
Figure 7. Scatter diagram for IPOs with proceeds of at least $5 million but less than $100 million in 1998. The sample consists of 278 firm commitment IPOs in 1998 with nominal proceeds of at least $5 million but less than $100 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. One IPO (with proceeds of $5.0 million) with the spread of 11.11% is not shown in the diagram.

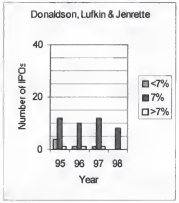
Figure 8. Gross spread distribution for moderate size IPOs underwritten by main investment bankers from 1995 through 1998.

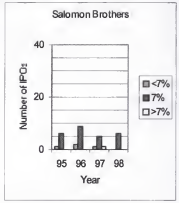
The sample is firm commitment IPOs underwritten by twelve main investment bankers from 1995 through 1998 with proceeds of at least $20 million but less than $80 million (expressed in terms of dollars of 1997 purchasing power) before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. There are three categories of gross spreads expressed as a percentage of proceeds: below 7%, 7%, and above 7%. Salomon and Smith Barney merged in late 1997. Deals led by Salomon Smith Barney are attributed to Salomon. Morgan Stanley includes Morgan Stanley Dean Witter, Robertson Stephens includes BA Robertson Stephens and BancBoston Robertson Stephens, Alex Brown includes BT Alex Brown, and Montgomery includes Nationsbanc Montgomery.

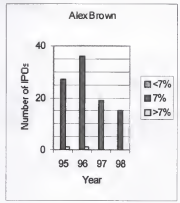

Goldman Sachs
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Morgan Stanley
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Merrill Lynch
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Donaldson, Lufkin & Jenrette
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Salomon Brothers
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Alex Brown
Number of IPOs
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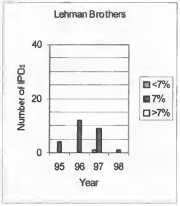
20
0
95 96 97 98
Year
<7%
7%
>7%


Lehman Brothers
Number of IPOs
40
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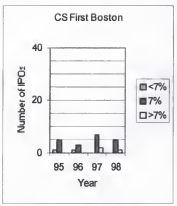
0
95 96 97 98
Year
<7%
7%
>7%


CS First Boston
Number of IPOs
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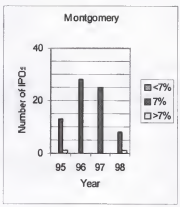
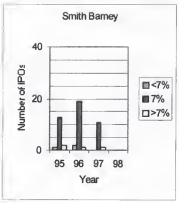
20
0
95 96 97 98
Year
<7%
7%
>7%


Montgomery
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Smith Barney
Number of IPOs
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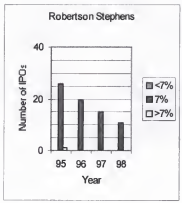
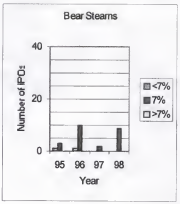
95 96 97 98
Year
<7%
7%
>7%


Robertson Stephens
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%


Bear Stearns
Number of IPOs
40
20
0
95 96 97 98
Year
<7%
7%
>7%

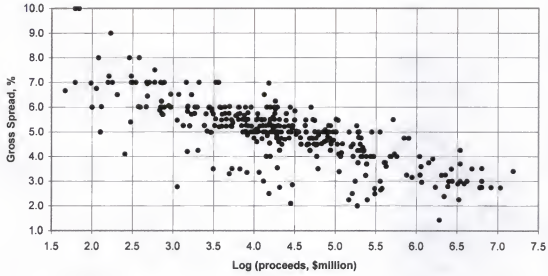


Figure 9. Scatter diagram for SEOs with proceeds of at least $5 million in 1998. The sample consists of 366 seasoned equity offerings (SEOs) with proceeds of at least $5 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample. The amount of proceeds is measured in millions of dollars and then the natural logarithm is taken. One SEO (proceeds of $268.3 million) with a spread of 0.69% is not shown in the diagram. This was from Flextronics International, a company from Singapore.

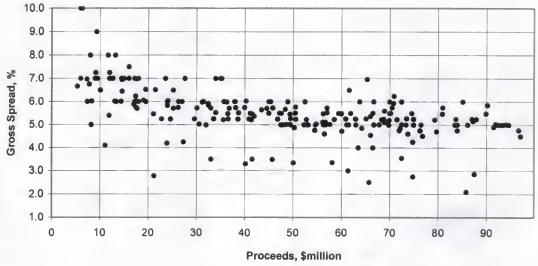


Figure 10. Scatter diagram for SEOs with proceeds of at least $5 million but less than $100 million in 1998. The sample consists of 228 seasoned equity offerings (SEOs) with proceeds of at least $5 million before the exercise of the overallotment option. Closed-end funds, REITs, ADRs, and unit offerings are excluded from the sample.

CHAPTER 3
COMPETITION AND COLLUSION IN THE IPO MARKET

Introduction

The investigation of Chapter 2 gives the following facts. Over 90% of U.S. corporations that went public using firm commitment offerings to raise proceeds ranging from $20 million to $80 million in 1995-1998 paid exactly 7.0% of the proceeds to investment bankers. For large offerings that raised more than $80 million, average gross spreads are below 7.0% and there is little clustering on a single number.

Chapter 2 has discussed several possible explanations for the 7.0 percent clustering. The purpose of this chapter is to offer a game-theoretic model, as one possible explanation, for the above pricing pattern of investment bankers. The model demonstrates that investment bankers, though competing on spreads, can still sustain profitable equilibria in a stochastic and infinite horizon setting. In the setup of the model, the perfect competition equilibrium is one of the candidates of equilibria. However, the perfect competition outcome is not in the best interests of investment bankers. Investment bankers prefer outcomes with higher profits if they can find some pricing strategies that constitute profitable equilibria. In the dynamic game literature (e.g., Rotemberg and Saloner, 1986; Dutta and Madhavan, 1997) such pricing behavior is termed "implicit collusion" because investment bankers, while acting in their own

interest, set spreads above the competitive level and earn abnormal profits without any formal agreement about how to charge in the IPO market.[1]

In the most profitable noncooperative equilibrium (call it "the second-best equilibrium"), investment bankers can sustain a high spread for a wide range of offerings and they have to charge lower spreads for sufficiently large offerings to keep other underwriters from undercutting. Also, the empirical pattern is consistent with the prediction of this equilibrium. The notion underlying the second-best equilibrium is similar to those of Rotemberg and Saloner (1986) and Dutta and Madhavan (1997). In an oligopolistic pricing model over the business cycle, Rotemberg and Saloner show that firms set relatively low prices during periods of high demand in equilibrium. Dutta and Madhavan offer a model to explain market maker's pricing behavior on Nasdaq. When expected volume is less than a critical level, dealers set prices equal to those set under overt collusion. If the volume shock is above the critical level, dealers narrow the bid-ask spreads to prevent individual dealers from defecting from the proposed equilibrium spreads. The model in section 2 is based on the framework of these papers.

The model suggests that investment bankers are able to sustain a high spread for offerings smaller than some critical level and they have to charge lower spreads for

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[1] In the same spirit, Andrew D. Klein, founder of Wit Capital that distributes IPO shares over the Internet, has the following comment: "Out of mutual self-interest, most bankers have lived by a not-needed-to-discuss code that they wouldn't cut spreads." See *Business Week*, November 9, 1998. Also, an anonymous head of underwriting for an investment bank says of the gross spread, "The fact is, we'd been cutting our own throats to compete on price." See *Wall Street Journal*, page C1, April 10, 1997.

sufficiently large offerings to prevent other investment bankers from undercutting. The prediction is consistent with the pattern observed in Figure 6 of Chapter 2. Another implication of the model is that the critical offering size increases and it is easier to implicitly collude for investment bankers when more IPOs are brought to the market during a fixed calendar period (for example, a year). The cost of defecting from the "implicit collusion" equilibrium is high in the more active IPO market since investment bankers give up more expected profits during a fixed calendar period if they undercut spreads. The implication is also consistent with the fact that it is a high IPO volume period from 1995 through 1998.

Section 2 presents the model and analyzes the second-best strategy. Some caveats about the model are also given. Section 3 concludes the chapter. Proofs of propositions are delegated to the appendix.

An Implicit Collusion Model for the IPO Market

Basic Setup

Consider M symmetric investment bankers providing underwriting service in an infinite-horizon setting. At the start of each period, one firm needs the underwriting service of one investment banker to help it to go public. The new issuing firm is characterized by gross proceeds raised before the fee charged by its underwriter. Let P_t be the gross proceeds or offering size at time t. We assume the amount of proceeds for issuing firms is independent and identically distributed from period to period and regard it as the random variable P that has domain $[\underline{P}, \overline{P}]$ and has a distribution $F(P)$. After observing the size of an issuer in each period, M investment bankers simultaneously

quote their spread levels at which they are willing to provide underwriting service. Since the offering size of new issuing firms may be different from period to period, this game is a dynamic game rather than a repeated game in which the proceeds or economic environment is constant in each period. There is no private information, so we have a dynamic game with complete information.

We assume the expected profit function of investment bankers as a group is $\pi(S; P_t)$ and the function is strictly concave in the underwriter spread S and increasing in the proceeds P_t.[2] Formally, the monopoly spread is

$$S^m = \arg\max_S \pi(S; P_t).$$

When investment bankers form a cartel and charge a monopoly spread S^m, they are able to earn the maximal profit from the perspective of the whole investment banking industry. For analytic simplicity, we assume that there are no fixed costs of underwriting. Instead, the underwriting technology has constant returns to scale as represented by total costs on a deal that are proportional to proceeds, total costs = cP.

When investment bankers set the spread equal to the marginal cost c, they earn no economic profits. It is easy to see that when each investment banker charges an underwriting spread at the marginal cost c in each period no matter what spreads other

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[2] One example of expected profit function is $\pi(S; P_t) = \phi(S) \cdot (S \cdot P_t - c \cdot P_t)$, where $\phi(S)$ is the probability that the issuing firm will accept the deal under the spread of S. Also, assuming that the function $\phi(S)$ is strictly decreasing and $\phi(S) \cdot \phi''(S) < 2(\phi'(S))^2$ can assure the existence of the monopoly spread.

investment bankers charge, this pricing behavior constitutes a subgame-perfect Nash equilibrium. First, investment bankers will not charge below c since they are going to make losses and will be better off by choosing not to participate in the game or simply charging c. Second, when all investment bankers charge above c, one investment banker can make more profits by undercutting the prevailing spread. Finally, after any previous history of play, the strategy requires each investment banking firm to set its spread equal to c in every future period regardless of its rivals' behavior. Since each investment banker earns at most zero when its opponents set their spreads equal to c, and it earns exactly this amount by setting its spread equal to c in each future period, the strategy of "pricing at marginal cost" in all periods is a subgame perfect Nash equilibrium.

Although "pricing at marginal cost" is a sustainable equilibrium of the pricing game played by investment bankers, the competitive outcome does not coincide with the best interests of investment bankers as a whole group. Investment bankers may prefer to form a cartel to capture the monopoly rent. But they cannot reach such cooperative agreements easily for two reasons. First, explicit price fixing agreements violate the antitrust law. Second, investment bankers have incentives to deviate from cooperative agreements by undercutting spreads when they observe some large firms are going to go public. Therefore, explicit collusion cannot be sustained for all periods, even if investment bankers understand it is beneficial for them to cooperate in the long run.

In the dynamic context, we still can find some equilibria in which investment bankers act noncooperatively and make positive profits. We are especially interested in looking for the "second-best" equilibrium, which is defined as a noncooperative

equilibrium that has the highest possible profit for the whole investment banking industry among noncooperative equilibria.[3] We call this the implicit collusion equilibrium.

The Second-best Equilibrium

Assume the current realization of the IPO proceeds is P'. Let $J(P)$ denote the total expected present value of future profits to the whole investment banking industry under the second-best strategy and $\pi(S'; P')$ be the current profits to investment bankers as a group from charging the spread S'. Similar to the argument of dynamic programming, the value function $J(P')$ for the second-best strategy can be expressed in terms of current-period profits plus the present value of future expected profits, as

$$J(P') = \max_{S'} [\pi(S'; P') + \rho E(J(P))] \tag{3-1}$$

$$\text{s.t. } \frac{1}{M}[\pi(S'; P') + \rho E(J(P))] \geq \pi(S; P') \tag{3-2}$$

for all $S \leq S'$, where ρ ($\rho \equiv 1/(1+r)$ and r is the discount rate for one period between transactions) is the one-period discount factor for all M investment bankers.

Equation (3-1) is known as the Bellman equation. Constraint (3-2) is the incentive compatibility condition. It means that the expected profits from following the second-best strategy are greater than one-shot profits from deviating from the strategy and charging a lower spread. Specifically, an investment banker sets spreads equal to the suggested spreads according to the second-best strategy and expects the tacit pricing to

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[3] As described in Dutta and Madhavan (1997), the "first-best" equilibrium refers to overt collusion since it yields the highest profits for the investment banking industry. Note that overt collusion is not an equilibrium of the noncooperative pricing game discussed in this chapter.

continue through the future. From the assumption of symmetric investment bankers, the investment banker's expected profits are decomposed as follows: he receives an immediate profit of $\frac{1}{M}\pi(S';P')$ and he also receives the expected discounted continuation payoff of $\frac{1}{M}\rho E(J(P))$.[4] For the R.H.S. of (3-2), if the investment banker undercuts the spread to capture the market, the investment banker earns $\pi(S;P')$ for the current period and no profits for future periods, expecting other investment bankers thereafter to price at the marginal cost, which is the worst possible punishment. The optimization problem (3-1) means that investment bankers maximize their aggregate intertemporal profits subject to the incentive compatibility constraint (3-2). This is simply due to the definition of the second-best equilibrium.

From our assumptions, the expected value of future profit to the whole investment banking industry can be expressed as

$$E(J(P)) = \left(\frac{1}{1-\rho}\right)\int_{\underline{P}}^{\bar{P}} \pi(S(P);P)dF(P). \qquad (3\text{-}3)$$

If investment bankers expect future profits to be zero whether they cooperate at time t or not, the pricing game at time t will essentially be a one-shot game in which the well-known equilibrium is the competitive equilibrium. Lemma 3.1 characterizes the

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[4] The cooperative bargaining feature of the underwriting syndicate is not pursued here. While investment bankers share revenues through the underwriting syndicate, in practice, the lead manager grabs the lion share of revenues. Table 5 of Chapter 2 shows how the gross spread is split in a typical syndicate. Therefore, assuming each investment banker acts independently to try to lead the deal would be appropriate.

competitive equilibrium via the expected continuation payoffs in the second-best equilibrium.

Lemma 3.1: *The unique noncooperative equilibrium is the competitive equilibrium if and only if the expected continuation payoffs in the second-best equilibrium are zero, i.e., E(J(P))=0.*

Lemma 3.1 implies that if there exists a second-best equilibrium other than the competitive equilibrium, the expected continuation payoffs must be strictly positive. Since the time horizon of the pricing game is infinite, the extent of patience for investment bankers will affect the magnitude of the expected continuation payoffs. We now focus on the expected continuation payoff.

Note that the monopoly spread S^m maximizes the profit function, and at worst investment bankers get zero profits when they charge at c. The per-period payoff for each underwriter is nonnegative and bounded by $\pi(S^m; \overline{P})$ and hence $E(J(P))$ is also nonnegative and bounded above. When investment bankers are more patient, i.e., the discount factor ρ is larger and the future is appreciated more, investment bankers are less willing to undercut gross spreads to give up future profits. Intuitively, the expected discounted continuation payoff $K=\rho E(J(P))$ under any strategy will increase in the discount factor.

The following lemma, which is a variant of lemma 4 in Dutta (1995), captures the above intuition and facilitates the proofs of the later main propositions.

Lemma 3.2: *Consider any strategy σ and its associated outcome. Suppose, at a fixed discount factor ρ_1, the expected continuation payoff $E(J(P;\rho_1))$ is nonnegative after*

each finite history and suppose further that the per-period payoff for each underwriter is bounded. Then, the expected discounted continuation payoff under σ, *after each finite history, is nondecreasing in the discount factor, i.e.,* $K_2=\rho_2 E(J(P;\rho_2))$, $K_1=\rho_1 E(J(P;\rho_1))$, $K_2 \geq K_1$ *whenever* $\rho_2 \geq \rho_1$.

Since we are interested in the noncooperative equilibrium with the highest possible profits for the whole investment banking industry, it is beneficial to examine the extent to which the collusive spread is sustainable. When the collusive spread S^m is sustainable given current offering size P, it follows from (3-2) that

$$\frac{K}{M} \geq (1-\frac{1}{M})\pi(S^m;P). \qquad (3\text{-}4)$$

The L.H.S. of (3-4) is the expected continuation profits to an investment banker given that no other investment bankers deviate from the second-best strategy. $\frac{K}{M}$ thwarts an individual investment banker from charging a lower spread to capture the whole IPO market since it is the expected profits forgone in the future if someone defects. However, $\pi(S^m;P)$ is increasing in P and as a result, inequality (3-4) may not hold for a large offering size. This means the collusive spread can no longer be sustainable for large offerings since any investment banker has an incentive to undercut the spread to grasp the business of large offerings. Therefore, investment bankers will set spreads lower for larger offerings to keep an individual investment banker from cheating. It follows that investment bankers will sustain the collusive spread for small offerings and charge less for sufficiently large IPO firms.

On the other hand, Lemma 3.2 states that the expected continuation payoff K is higher when investment bankers are more patient. This makes (3-4) hold more easily and collusive pricing is sustainable in a wide range of offering size. In contrast, if investment bankers are impatient, they undercut spreads more easily and act more competitively. Then, constraint (3-2) may not hold and the competition equilibrium arises.

With the help of Lemma 3.1 and Lemma 3.2, Proposition 3.1 characterizes the second-best equilibrium.

Proposition 3.1: *There exists a constant $\rho_0 \in [1-1/M, 1)$ such that when $\rho > \rho_0$, the second-best strategy for any investment banker is as follows: 1) if the offering size is below a unique critical proceeds $P_C(\rho)$, where $\underline{P} \le P_C(\rho) \le \overline{P}$, charge the collusive spread S^m; 2) if the offering size is above the critical proceeds ($P > P_C(\rho)$), charge an underwriting spread $S^*(P)$, where $S^*(P) < S^m$; 3) if any investment banker deviates from this strategy, set the underwriting spread at* c *in each period onwards.*

When $\rho \le \rho_0$, the unique equilibrium is the competitive equilibrium and charge the underwriting spread at c in each period.

Proposition 3.1 shows that if investment bankers are sufficiently impatient (with low discount factor), the competitive equilibrium is the only equilibrium. If investment bankers are patient enough, their pricing behavior is like "implicit collusion" for offerings below some critical level of offering size, and they will charge lower spreads to prevent defection of individual investment banker for larger issues. Note that "implicit collusion" in the second-best equilibrium is distinct from "overt collusion". For overt collusion, investment bankers charge a unique profit-maximizing spread for all new issues (this

assumes that no economies of scale exist). However, in the second-best equilibrium, investment bankers recognize their dynamic interdependence of their respective pricing behavior and charge different spreads for different size of IPOs.

We define "the start of each period" as when one new issuing firm needs underwriting services and will go public. That is, each period represents one transaction. To address empirical questions, it is interesting to analyze the effect of changes in the frequency of going public during a fixed calendar period. When more IPOs are brought to the market in a fixed calendar period, the discount factor used between transactions becomes larger (the discount rate becomes smaller because it is for a shorter time period) assuming that the discount rate used during a fixed calendar period is unchanged. Hence, investment bankers act as if they are more patient in the "hot" market than in the "cold" market. By Lemma 3.2, the expected discounted continuation payoffs will increase. Intuitively, as investment bankers recognize relatively more profitable opportunities in the "hot" market, they are less willing to undercut spreads to give up future profits. Thus, it is easier for investment bankers to implicitly collude in the hot IPO market. This may seem counter to the Rotemberg and Saloner (1986) result that it is more difficult to collude during booms. The difference in results is because Rotemberg and Saloner are defining a boom as high current volume relative to the present value of future volume. Here, the present value of future volume increases relative to the current *transaction* in a hot market. Proposition 3.2 characterizes the nature of changes in the frequency of going public.

Proposition 3.2: *Given the second-best strategy, when more IPOs are brought to the market during a fixed calendar period, it is easier to implicitly collude for investment bankers, i.e., P_C increases.*

Chapter 2 shows that there were roughly 360 IPOs with proceeds of at least $20 million per year during 1995-1998. This average number of IPOs is far greater than that for the period 1991-1994, which was about 260 IPOs per year. Therefore, the period 1995-1998 has seen a relatively hot IPO market. Consistent with the prediction of Proposition 3.2, 91% of moderate-size IPOs have paid the same gross spread of 7.0 percent and this partly reflects reluctance of investment bankers to undercut spreads during the relatively hot period.

Caveats

The above dynamic game-theoretic model is based upon certain assumptions that deviate from the institutional framework of the IPO underwriting business. First, it assumes that there are constant returns to scale (the marginal cost of underwriting is c) rather than being characterized by a fixed cost and declining average costs. Second, the model assumes no capacity constraints: a given underwriter can capture all of the underwriting business in a period if it charges the lowest spread, no matter how large the deal. In reality, for all but the largest underwriters, either lowering the offer price or forming a syndicate to share the risks and market a large deal would be required. Furthermore, there are constraints on grabbing numerous deals in an active market because writing a prospectus in a manner that will be approved by the S.E.C. takes time, as does scheduling and conducting a road show. In other words, there are increasing marginal costs of underwriting in the short run for any given underwriter.

Third, the model assumes, as is typical in models of dynamic games with complete information, that in the second-best equilibrium a potential price-cutter assumes that other underwriters will respond by setting spreads equal to marginal cost for all future deals. This threat, with its maximum penalty to a price-cutter, achieves maximal deterrence. It is not at all clear how time-consistent this threat is, however. If the deterrence fails, and one underwriter cuts its spreads, it is not obvious that *ex post* the best response is to cut all future spreads to marginal cost, rather than earn some economic profits on a smaller market share with spreads still above marginal cost. This time-consistency problem is not unique to my model, but is instead a generic problem in game theory.

Fourth, the model assumes that penalties occur entirely in the price dimension; future spreads are set equal to marginal cost. In reality, other underwriters have an opportunity to impose a quantity penalty by excluding a price-cutter from future syndicates.

I conjecture that the effect of all of these deviations from the formal model above is to have an equilibrium where the sustainable spread is above marginal cost, but below the monopoly spread. In other words, the qualitative results from the noncooperative dynamic game that I have modeled above are likely to hold. Investment bankers realize that they don't want to turn IPO underwriting into a "commodity business."

Conclusions

This chapter presents a game theoretic model to explain the pattern of clustering spreads for a wide range of offerings and of lower spreads for large offerings in the IPO

market. In a stochastic and infinite horizon setting, investment bankers while acting noncooperatively may charge underwriting spreads above competitive levels in equilibrium. The model implies that investment bankers are able to sustain a high spread for offerings smaller than some critical level and they have to charge lower spreads for sufficiently large offerings to prevent other investment bankers from undercutting. Another implication of the model is that when more IPOs are brought to the market during a fixed calendar period, it is easier to implicitly collude for investment bankers. The cost of defecting from the "implicit collusion" equilibrium is high in the more active IPO market since investment bankers give up more expected profits during a fixed calendar period if they undercut spreads. Interestingly, the evidence of underwriting spreads from the 1990s is consistent with the implications of the implicit collusion model.

CHAPTER 4
SUMMARY AND CONCLUSIONS

This dissertation has examined gross spreads on IPOs in the U.S. and several facts emerge. First, gross spreads received by underwriters on IPOs in the U.S. are much higher than in other countries. Second, in recent years at least 90 percent of deals raising between $20-80 million, which are referred to moderate-size IPOs, have spreads of exactly 7.0 percent. Third, the clustering of spreads at 7.0 percent for moderate-size IPOs has increased over time. For comparison, only 26 percent of moderate-size IPOs in 1985-1987 had 7.0 percent spreads. But the average spread on moderate-size IPOs has remained virtually constant during the 1985-1998 period.

There is widespread agreement that fixed costs exist in underwriting IPOs, yet investment bankers charge the same 7.0 percent spread on $20 million deals as they do on $80 million deals. I argue that for most IPOs with gross proceeds larger than $30 million, spreads are above competitive levels in the U.S. The high average spread and the concentration of spreads at 7.0 percent is consistent with implicit collusion on the part of investment bankers. In other words, even though investment bankers are acting independently, average spreads are above competitive levels. Investment bankers realize that if one investment banker tries to win business by cutting spreads, the underwriting industry is likely to move to an equilibrium with low spreads, and lower compensation for corporate finance employees. Several features of the IPO underwriting market are conducive to spreads above competitive levels. The importance of analyst coverage and

buy recommendations, and the perceived importance of underwriter prestige, facilitate high spreads.

If gross spreads are above competitive levels, investment bankers have an incentive to use nonprice competition to attract deals. Although issuing firms face high and, for moderate-size deals, nonnegotiable spreads, issuers can still bargain on another dimension. In particular, by insisting on additional co-managers, issuing firms receive more extensive analyst coverage. I show that the number of co-managers has increased over the last decade, and that adding an additional co-manager adds between 0.36 and 0.55 net analysts following the stock.

Several commercial banks entered the underwriting business during 1997-1998. But in the year after Nationsbank, Bankers Trust, BankAmerica, and BancBoston bought investment banking firms that specialized in IPOs, there does not seem to have been any impact in the IPO market. Another source of competition may emerge from the innovation of internet technology. For example, new underwriters E*Offering and W. R. Hambrecht threaten to undercut the 7.0 percent fee that is now standard. Only time will tell whether this changes the gross spreads that prevail in the IPO underwriting industry.

APPENDIX
PROOFS OF THE MAIN RESULTS IN CHAPTER 3

Proof of Lemma 3.1:

The part of necessity is obvious. To prove sufficiency, suppose there exists one equilibrium other than the competitive equilibrium. There must be some pricing rule that specifies the underwriting spread above the competitive level as the part of the equilibrium strategy other than the competitive equilibrium strategy. From (3-1), this will yield positive expected continuation payoffs to investment bankers as a group, a contradiction. Q.E.D.

Proof of Proposition 3.1:

Step 1: Based on the work of Abreu (1988), we know that the equilibrium strategy can be specified as two parts: (1) the initial path and (2) the punishment paths, one for each investment banker.

The initial path is followed in the event that no player deviates from this path in the past. And some punishment is imposed in the event that some player deviates from the initial path or from any punishment path. Further, the optimal punishment is the pricing rule that yields the lowest expected profit. Obviously, we can take the optimal punishment to be "pricing at marginal cost in each period." Now, we need to construct the initial path. Let $K=\rho E(J(P))$ be the present value of expected continuation payoffs to investment bankers as a group under the initial path. Suppose that the current size of the

IPO is P and K is greater than zero. From the incentive compatibility condition (3-2), the collusive price is sustainable if and only if

$$\frac{K}{M} \geq (1-\frac{1}{M})\pi(S^m; P)$$

Since $\pi(S^m; P)$ is strictly increasing in P, the above inequality may not always hold. Define critical offering size P_C as the solution to

$$\frac{K}{M} = (1-\frac{1}{M})\pi(S^m; P), \qquad \text{(A-1)}$$

if a solution exists. Note that P_C depends on ρ since $K=\rho E(J(P))$. If $\frac{K}{M} < (1-\frac{1}{M})\pi(S^m; \underline{P})$, then define $P_C=\underline{P}$. On the other hand, if $\frac{K}{M} > (1-\frac{1}{M})\pi(S^m; \overline{P})$, then define $P_C=\overline{P}$.

Construct the initial path as follows: (1) For $P \leq P_C$, price at the collusive spread S^m. (2) For $P>P_C$, price at S^* which solves

$$\frac{K}{M} = (1-\frac{1}{M})\pi(S^*; P). \qquad \text{(A-2)}$$

Note that $S^*<S^m$ because we restrict $S^* \leq S^m$ and S^* can not be equal to S^m from (A-2).

The construction of the initial path and the punishments gives the second-best strategy. To make this clear, observe that the incentive compatibility condition is always satisfied and the pricing strategy is deviation-proof, if investment bankers follow this second-best strategy from the next period onward. Furthermore, the strategy achieves the highest profit among the sustainable set of prices. From the second-best strategy and (3-1), it follows that

$$J(P)=\begin{cases}\pi(S^m;P)+K & for\ P\le P_C\\ \frac{K}{M-1}+K & for\ P>P_C\end{cases} \qquad \text{(A-3)}$$

Combination of (3-4) and (A-3) implies

$$E(J(P))\le\frac{MK}{M-1}, \text{ for all } P. \qquad \text{(A-4)}$$

Substituting $K=\rho E(J(P))$ into (A-4), we have the inequality $\rho\ge(1\text{-}1/M)$ since we assume $K>0$ at this point. Therefore, if $\rho<(1\text{-}1/M)$, then $K=0$ and the unique equilibrium is the competitive equilibrium from Lemma 3.1.

Step 2: In step 1, we suppose $K>0$. Here, we show that the expected discounted continuation payoffs are positive for sufficiently large discount factors. In fact, there exists $\rho_0<1$ such that $K>0$ for $\rho\ge\rho_0$. To show this, we construct another equilibrium for an appropriate discount factor: choose any $P_0>\underline{P}$ and for $P\le P_0$, charge the underwriting spread according to the collusive pricing strategy while for $P>P_0$, price at the marginal cost. Lemma 3.1 tells us the underwriting spread for $P>P_0$ is the equilibrium price. Let K_0 be the expected lifetime payoff to this strategy. We have

$$K_0=\frac{\rho}{1-\rho}\int_{\underline{P}}^{P_0}\pi(S^m;P)dF(P). \qquad \text{(A-5)}$$

The strategy is incentive compatible for $P\le P_0$ if and only if

$$\frac{K_0}{M}\ge(1-\frac{1}{M})\pi(S^m;P), \qquad \text{(A-6)}$$

for $P\le P_0$. From (A-5), there exists an appropriate discount factor $\rho_0<1$ such that (A-6) holds. Since the profits to this strategy are strictly positive from the right hand side of (A-

6), it follows that the second-best profits are strictly positive for $\rho=\rho_0$. Hence, Lemma 3.2 implies that $K>0$ for $\rho\geq\rho_0$.

Using step 1 and step 2, we have established that there exists a discount factor $\rho_0\in[1\text{-}1/M,\ 1)$ such that: (1) for $\rho<\rho_0$, the unique equilibrium is the competitive equilibrium and $K=0$; (2) for $\rho\geq\rho_0$, the second-best pricing strategy exists and is described as in step 1 and $K>0$. Q.E.D.

Proof of Proposition 3.2:

Let R denote the discount rate over a fixed calendar period (for instance, a year) with n IPOs brought to the market. Therefore, in the model, there are n periods during the fixed calendar period and the discount factor between any two IPOs will become

$$\rho_n = (\frac{1}{1+R})^{\frac{1}{n}},$$

and we have

$$\frac{d\rho_n}{dn} = \frac{\rho_n}{n^2}\ln(1+R) > 0.$$

When the frequency of going public increases during a fixed calendar period, the discount factor applied to the next IPO, ρ_n, increases monotonically. From Lemma 3.2, K increases as ρ_n increases and in turn P_C increases, this follows directly from the definition of P_C. Hence, as n increases, it is easier to implicitly collude among investment bankers and the second-best profits also increase. Q.E.D.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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